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VAN BODEGOM (A. H.). **Rubbervretende mieren, een huisplaag.** [Ants that feed on Rubber, a domestic Pest.]—*Trop. Natuur* 30 no. 10-11 pp. 161-163, 1 fig. Batavia, 1941.

An ant, identified as *Monomorium latinode*, Mayr, attacked all rubber articles except tyres in the author's house in Java. Other houses in the locality were not infested. Recorded cases of injury to rubber by ants in the Netherlands East Indies are reviewed [*R.A.E.*, A 26 262, etc.].

SPEYER (E. R.). **Animal Pests.**—*Rep. exp. Res. Sta. Cheshunt* 26 (1940) pp. 49-56. Cheshunt, Herts., 1941.

Work at Cheshunt in 1940 was largely concerned with determining the effect on the red spider mite [*Tetranychus telarius*, L.] of contact sprays containing sodium selenate and the quantity of the selenate that can be incorporated with the soil without harming the growth of tomato plants. When sprays containing 1, 0.2, 0.1 or 0.005 per cent. selenate and 0.02 per cent. saponin were applied to the foliage of infested shoots with their stems in water and when infested shoots were kept with their stems in water containing these concentrations of the selenate, injury to the foliage was very considerable at all but the lowest concentration, at which, however, only a few young mites were killed. The strongest spray killed all the active stages and most of the resting stages of the mite, but the leaves were severely scorched.

Experiments in August with plants about 6 ins. high in "60" size pots (estimated to contain about 12 oz. soil, which absorbed about 75 cc. of liquid) kept in contact with infested plants showed that watering with 100 cc. of a 0.015 per cent. solution of the selenate conferred practical immunity from infestation for at least three months, without injuring the plants. When the percentage was 0.03, some injury resulted but the plants recovered; no infestation developed. Similar immunity for five months without injury was observed in plants 14 ins. high in size "32" pots that were watered in July with a 0.1 per cent. solution. Plants 10-12 ins. high treated in November were injured by all solutions containing more than 0.006 per cent. selenate, but plants up to 5½ ins. in height tolerated higher concentrations. When slightly infested plants 12-16 ins. high were watered in August with a 0.015 per cent. solution, no severe infestation developed and the early scorching was soon overcome. The plants fruited as the controls. No scorching occurred on severely infested plants 20-22 ins. high watered in August with 300 cc. of solutions containing 0.1, 0.05 or 0.33 per cent. selenate; the infestations died out on those that received the two strongest solutions and was reduced on those that received the weakest.

In experiments on the substitution of molasses for the treacle in the poison bait commonly used against the tomato moth [*Polia oleracea*, L.] in glasshouses [*cf. R.A.E.*, A 8 61, 518], cane molasses was as effective as treacle, but beet molasses was inferior. The mixture of two parts ale and one part cane molasses dried up quickly, and an increase to three parts ale was more satisfactory. The practice of hanging moth jars from the wires in tomato houses appears to be falling into disrepute, and it is pointed out that this method of control is an essential adjunct to spraying early in the season with lead arsenate, if severe infestations are to be avoided.

In cage experiments to determine whether sodium arsenite or thallous sulphate would be more effective than sodium fluoride in the bait, a considerable number of moths died after feeding on baits containing 0.1 per cent. and especially 0.25 per cent. sodium arsenite, but large egg-masses were deposited on the foliage; thallous sulphate (0.6 per cent.) had no effect on the moths; 1 per cent. sodium fluoride killed a high percentage of moths over 2-4 days, and very few eggs were laid.

Greenhouse tomato plants growing in soil treated in May with 2 or 5 gals. per square yard of mixtures of dichlorethyl ether and water (1:250, 1:500 and 1:

1,000) showed limpness and yellowing of the foliage on the lower branches by June. The plots were replanted in mid-July, but the new plants also developed severe injury. It is concluded that dichlorethyl ether could not be safely applied for the control of wireworms to soil in which tomatos are grown.

PLUMMER (C. C.), MCPHAIL (M.) & MONK (J. W.). **The Yellow Chapote, a native Host of the Mexican Fruitfly.**—*Tech. Bull. U. S. Dep. Agric.* no. 775, 12 pp., 4 figs., 7 refs. Washington, D.C., 1941.

Sargentia greggii is widely distributed in Mexico to the south of the *Citrus* plantings in the lower Rio Grande Valley and also occurs at Brownsville, Texas. The fruits of this tree are infested by *Anastrepha ludens*, Lw., and a study was therefore made in north-eastern Mexico in 1936–39 of its attractiveness to this fruit-fly. The trees bloom between January and March, but often produce no fruit, and off-season bloom and fruit may be produced under wet conditions. The larvae of *A. ludens* sometimes occur in the flesh of the fruit, but usually feed within the seeds. Field collections showed that the average numbers of larvae per fruit ranged up to 0.88, depending on a number of factors, including the size of the fruits and the season. Considerable numbers of the parasites, *Diachasma (Opilus) crawfordi*, Vier., and *D. (O.) cereum*, Gah., were bred from infested fruits of the normal summer crop, but they were very scarce in infested fruit collected in winter. *Lonchaea (Carpolonchaea) pendula*, Bez., which is believed to be a scavenger, was also reared from infested fruit of the summer crop. Records of the *Anastrepha* population in grapefruit and in *S. greggii* were obtained by means of traps hung in the trees. It was found that the population in grapefruit was very low in summer, but higher in autumn and spring, the maximum numbers being caught in March and April. In *S. greggii*, the maximum numbers were caught in the first half of April, and, except in spring, the population was relatively low throughout the year, unless flies emerged as a result of infestation of summer or off-season fruit, though there were slight increases in the autumn months. The flies probably remain in one place or tree only as long as food and conditions for reproduction are favourable. Both trees appear to be attractive in spring, when they are blooming and setting fruit, and flies may go to either. The numbers that come to grapefruit trees in autumn seem to depend on the production and infestation of fruit of *S. greggii* during the previous summer.

CRUMB (S. E.), EIDE (P. M.) & BONN (A. E.). **The European Earwig.**—*Tech. Bull. U. S. Dep. Agric.* no. 766, 76 pp., 27 figs., 65 refs. Washington, D.C., 1941.

The following is based on the authors' summary of this paper, which includes descriptions of all stages of *Forficula auricularia*, L., and the various types of injury that it causes, a review of its distribution, a discussion of the climatic factors associated with recorded outbreaks in Europe and of the suitability of various regions of the United States for its survival, and an account of its bionomics and of experiments on its control. *F. auricularia* has become established in nine States, most of the infestations originating during the period 1910–20, when it was particularly abundant in north-western Europe. Its survival and abundance depend largely on the degree of desiccation to which it is subjected; it is best adapted to cool latitudes and becomes less abundant where the mean temperature for July approaches 75°F. The nymphs, in particular, are subject to fungous diseases in cold, wet weather. Outbreaks occur in Europe only when the period from March to August, inclusive, is distinctly warmer and drier than usual, and when this period in the preceding year was at least somewhat drier than normal.

The earwig is omnivorous, but prefers low forms of plants such as mosses, lichens and algae to most higher forms. It is capable of damaging a wide

variety of plants, but is important mainly as a nuisance in and about dwellings. It also feeds to some extent on other insects. The eggs are deposited in cells in the soil (in January and February in Washington State) and hatch during April; the adults first appear in July. Some females re-enter the soil about a month after the first eggs have hatched and deposit a second batch of eggs, which hatch in June and give rise to adults in late July or early August. Pairs of earwigs form cells for hibernation late in September and during October. Winter survival is highest in loamy soils and is low in heavy soils or sand. Eggs are deposited within two inches of the surface of the soil, the average number being about 30 for each female in the case of the first lot and considerably less than this for the second. The duration of the egg and nymphal stages is influenced by temperature. The egg stage lasts about 72.8 days in winter and about 20 days in spring. The four nymphal stages are completed in about 68 days or more. The earwig rarely flies but may be carried long distances in merchandise, luggage or vehicles. It is parasitised in Europe by the Tachinids, *Bigonicheta setipennis*, Fall., and *Rhacodineura pallipes*, Fall. (*antiqua*, Mg.), of which the former is the more important and has been introduced into the United States [cf. *R.A.E.*, A 27 379].

A bait consisting of 12 lb. wheat bran, 1 lb. sodium fluosilicate and 1 U.S. quart fish oil, scattered thinly over the whole of the infested area, was the most satisfactory of those tested in field and laboratory investigations, but in most cases it is essential that the whole of a city block should be baited at the same time for the best results. One thorough application of the bait should control the insect for the remainder of the season. Of nine repellents tested, cresol was by far the most effective.

WINGO (C.). **The Importance and Use of Parasites in the Control of Oriental Fruit Moth.**—*Proc. Mo. Acad. Sci.* 5 no. 4 pp. 122-124. 1940. (Abstr. in *Exp. Sta. Rec.* 85 no. 1 p. 88. Washington, D.C., 1941.)

Following liberations of *Macrocentrus ancylivorus*, Rohw., in orchards infested by the oriental fruit moth [*Cydia molesta*, Busck] in Missouri, this parasite was recovered in all but one of the counties in which it had been released. In 1938, the percentage of larvae of *Cydia* parasitised throughout the State averaged 28.4 and in some places reached 54, of which 76 per cent. was due to *M. ancylivorus*. In 1937, 15 per cent. of the second-generation larvae in two orchards in one county were attacked by the native parasite, *Eubadizon pleuralis*, Cress., and in 1938, 85 per cent. of the total parasitism (34 per cent.) in another county was due to this species. The only other native parasite that was generally sufficiently abundant to be of importance was *Glypta rufiscutellaris*, Cress., which in some places parasitised as many as 6 per cent. of the larvae.

BUZACOTT (J. H.). **The Relationship between Hardness of Sugar Cane and varietal Resistance to the Beetle Borer *Rhabdocnemis obscura* Boisd.**—*Tech. Commun. Bur. Sug. Exp. Stas Qd* 8 pp. 127-152, 13 figs. 1940. (Abstr. in *Exp. Sta. Rec.* 85 no. 1 p. 90. Washington, D.C., 1941.)

Larvae of *Rhabdocnemis obscura*, Boisd., can develop in both hard and soft varieties of sugar-cane, but the larval period appears to be extended, and fewer eggs are deposited, in hard canes. Hardness is due to the number, form and arrangement of the peripheral vascular bundles and appears to be closely related to the fibre content of the cane; preliminary work in Queensland indicated that the introduction of a hard parent into a cross increases the average hardness of the progeny. Artificial trashing reduces infestation, but does not increase hardness; self-trashing varieties are more resistant than those that are not self-trashing [cf. *R.A.E.*, A 27 186]. Other factors contributing

towards resistance to attack by *R. obscura* are erectness of habit [*loc. cit.*] and resistance to top-rot, and if due allowance is made for these, the susceptibility of a variety can be forecast from a consideration of the hardness.

WALLACE (C. R.). Some common Insects of Lucerne in New South Wales.—
J. Aust. Inst. agric. Sci. 7 no. 2 pp. 83-85. Sydney, 1941.

Surveys of insects associated with lucerne were made in five districts of New South Wales during the first three months of 1940 and between September 1940 and May 1941. Lists are given of species of which lucerne is believed to be the natural habitat, since they occurred on it in numbers in several localities and months of the year, were often accompanied by larvae or nymphs, and were very abundant in at least one crop, and of others that were prevalent but not outstanding as regards geographical range, consistency of occurrence and abundance. Species of which the immature stages were observed included the Capsid, *Megacoelum modestum*, Dist., the Coreid, *Mirperus scutellaris*, Dall., the Lygaeid, *Nysius vinitor*, Bergr., the Lycaenid, *Zizera (Zizeeria) labradus*, Godt., *Heliothis armigera*, Hb., *Tortrix divulsana*, Wlk., the Geometrid, *Chloroclystis laticostata*, Wlk., and a Eurytomid, *Bruchophagus* sp. Three Jassids, *Empoasca terrae-reginae*, Paoli, *Nehela torrida*, Evans, and *Thamnotettix argentata*, Evans, were accompanied by nymphs, the identity of which was not determined. Several Hymenopterous and Dipterous parasites were bred from the Lepidoptera, and predacious insects included *Nabis capsiformis*, Germ., the Pentatomids, *Oechalia consocialis*, Boisd. (*schellembergi*, Guér.) and *Cermatulus nasalis*, Westw., and the Coccinellids, *Verania (Alesia) frenata*, Erichson, *Scymnus notescens*, Blkb., and *Coccinella repanda*, Thnb. Only one individual of *Nezara viridula*, L., was observed, and its scarcity is probably due to the introduction of *Microphanurus basalis*, Woll. [*R.A.E.*, A 25 737]. The Coccid, *Steatococcus nudatus*, Mask., was found at two places, in one of which the lucerne was severely affected by the virus [*Chlorogenus medicaginis* of Holmes] causing witch's broom disease [*cf.* 24 786].

Supplementary information given was obtained by examining insect collections.

PEMBERTON (C. E.). Contributions of the Entomologists to Hawaii's Welfare.—
Hawaii. Plant. Rec. 45 no. 2 pp. 107-119. Honolulu, 1941.

The author discusses the importance of the introduction into Hawaii of the natural enemies of insect pests, which are themselves species that have been imported and therefore lack indigenous enemies, and gives examples of successful biological control in the past. He emphasises the value of the work done by entomologists, not only by the investigators who discover beneficial insects in other parts of the world, but also by those who rear the insects and eliminate any injurious species that may accompany them, and by taxonomists, who identify the pests and indicate the regions in which their enemies are likely to occur. In view of the importance of continued explorations and research in biological control, he suggests the maintenance of one or more field laboratories, operated by entomologists from Hawaii, in specially selected foreign regions, and he gives reasons for considering Malaya to be the most suitable for this purpose.

BRITISH GUIANA. Plant Protection Ordinance, 1942.—8 pp. Georgetown, 30th January, 1942.

This Ordinance, which supersedes an earlier one [*R.A.E.*, A 24 618], somewhat extends the powers of the Governor in Council in making regulations designed to prevent the introduction into British Guiana of pests and diseases of plants and to effect the eradication or prevent the spread of any that occur there. Provision for the certification of plants for export is included.

LÓPEZ CRISTÓBAL (U.). **El pulgón verde de los cereales** (*Toxoptera graminum* Rondani). **Lucha biológica—química—mecánica.** [The Green Aphid of Cereals. Its biological, chemical and mechanical Control.]—7 pp., 5 figs., multigraph. [Buenos Aires] Div. Zool. agríc. Dir. Sanid. veg. Minist. Agric. [Argent.], 1941.

Data on the bionomics of *Toxoptera graminum*, Rond., and its importance as a pest of cereals in Argentina, where it was first observed in 1937, are reviewed [cf. *R.A.E.*, A 25 631 ; 26 289]. It reproduces asexually throughout the year, and there may be as many as 14 generations from May to November. It is favoured by temperatures not exceeding 20°C. [68°F.] and is resistant to frost. Development and reproduction are inhibited by temperatures in excess of 30°C. [86°F.], and during hot weather the Aphid seeks refuge among wild grasses. It prefers young plants, particularly oats and barley. Its chief parasite in Argentina is *Aphidius platensis*, Bréth. [cf. 26 289, 290], but some control is afforded by the predacious Syrphid, *Allograpta exotica*, Wied., and various Coccinellids, and these and other possible natural enemies should be protected and distributed. During wet weather in May, over 20 per cent. of the Aphids in fields in the south of the Province of Buenos Aires were killed by the fungus, *Acrostalagmus aphidum*. Control measures include burning infested plants as soon as the Aphid is observed. Valuable seed crops can be protected with dusts of nicotine sulphate, pyrethrum or rotenone, or with one containing 5 per cent. dinitro-ortho-cresol, which is the most effective but scorches the plants.

LÓPEZ CRISTÓBAL (U.). **El "gusano del duraznero"** *Cydia* (*Laspeyresia*) *molesta* Busck. [The Peach Moth, *C. molesta*.]—5 pp., multigraph. [Buenos Aires] Div. Zool. agríc. Dir. Sanid. veg. Minist. Agric. [Argent.], 1941.

A brief account is given of the bionomics of *Cydia molesta*, Busck, on peach in Argentina, where it produces 4-8 generations from August to April. If peach trees with abundant tender shoots are available as traps, almost all the first-generation larvae can be destroyed by removing and burning the infested shoots. Insecticides against the eggs or adults are not suitable for conditions in Argentina, but sprays of lime-sulphur applied as soon as the shoots appear repel the ovipositing females. Much attention has been paid to biological control, and regular distribution is made of *Cremastus rubeo*, López Cristóbal, *C. flaviventris*, López Cristóbal [*R.A.E.*, A 27 237], *Ephialtes* (*Calliephialtes*) *argentinus*, Blanch. [27 601] and the imported Braconid, *Macrocentrus ancylicivorus*, Rohw.

HAYWARD (K. J.). **La "polilla negra" del duraznero** (*Cydia molesta* Busck). [The Oriental Peach Moth, *C. molesta*.]—*Circ. Estac. exp. agríc. Tucumán* no. 99, 10 pp., 5 figs. Tucumán, 1941.

Cydia molesta, Busck, was first observed in Argentina in 1931, when it was recorded on peach in Buenos Aires, and has recently spread to the Province of Tucumán. Its distribution and life-history and the morphology of all stages are described, and characters are given distinguishing the larva, pupa and adult from those of *C. pomonella*, L. Peach is its preferred food-plant, but it attacks several other fruits in Argentina [*R.A.E.*, A 24 24]; the author has bred it from almond shoots in Tucumán and the fruit of the wild *Eugenia myrcianthes* in Entre Ríos. It has up to 7 generations a year in Tucumán, where conditions are favourable to it, and no parasites have been observed. Destruction of infested shoots and fruit and the usual methods of orchard sanitation are advised for control. Control by means of sprays is difficult, and

the use of light traps would be impracticable. Bait-traps are recommended, however; they should be baited with 1 gal. molasses, 9 gals. water and 1 lb. yeast, and should be used at the rate of about 40 per acre.

Cawthron Institute, Nelson, New Zealand. Annual Report 1940.—38 pp. Nelson, N.Z. [1941.]

Parts of this report (pp. 22, 28-33) deal with work on insects in New Zealand [cf. *R.A.E.*, A 29 333]. Spray tests carried out on the eggs of the raspberry bud-moth [*Carposina adrepiella*, Wlk.] showed that red oil (1 : 25) gave complete control, whereas Volck oil (1 : 600) gave none. A colony of termites of the genus *Eutermes* was found in a pole in Hawke's Bay, North Island; the colony was destroyed and no other has been found.

The gorse-seed weevil [*Apion ulicis*, Forst.] introduced against gorse [*Ulex europaeus*] has become thoroughly established and spread rapidly in many districts; 30,500 weevils were distributed during the year, and the position is now so satisfactory that further distribution from the central breeding area is hardly necessary. There is normally one generation in the year, which develops in the pods produced from the winter flowering, but eggs in 1939 and all the immature stages in 1940 were found in pods produced in autumn, indicating that the insect is adapting itself to New Zealand conditions by developing two generations in the year. Almost mature larvae of *Hylemyia* (*Pegohylemyia*) *jacobaeae*, Hardy, which was liberated extensively against ragwort [*Senecio jacobaea*] in a new experimental area late in the summer of 1939-40, were found infesting flower-heads as much as 1,000 yards from the original point of liberation in the summer of 1940-41, but the population was not sufficiently dense to influence the weed to any marked extent. *Tyria jacobaeae*, L., has maintained such a heavy population on ragwort in one locality on the Waikato River [cf. 27 449; 28 566] since its liberation in 1932 that large numbers of eggs and larvae have been secured and distributed to other localities each year. The sawfly [*Antholcus varinervis*, Spin.] has been liberated on piripiri [*Acaena*] in an area near Nelson in order that frequent and regular observations could be made during the active period of the insect, from May to December. It was found that though the life-cycle is normally completed in one year, some individuals may remain in the prepupal stage throughout two seasons, and these tend to emerge as adults much earlier in the season than those with a yearly life-cycle.

GAY (F. J.) & RATCLIFFE (F. N.). The Importance of *Rhizopertha dominica* as a Pest of Wheat under wartime Storage Conditions.—*J. Coun. sci. industr. Res. Aust.* 14 no. 3 pp. 173-180, 10 refs. Melbourne, 1941.

Recent observations on the insects attacking stored wheat, together with the results of preliminary laboratory studies, indicate that the Bostrychid, *Rhizopertha dominica*, F., will probably be more injurious in Australia than *Calandra oryzae*, L., and *C. granaria*, L. An account is given of its history and occurrence in Australia, where it was a serious pest in 1917-19, and characters distinguishing it from other insect pests of stored grain are described. Infestation by it can be identified by the presence of large quantities of floury white frass, most of which consists of pulverised grain that is not ingested. Preliminary experiments indicated that it required a relatively high temperature for breeding, but does not need wheat with a high moisture content. Its numbers did not increase at 78.8°F., and increased more rapidly at 95 than at 90°F.; some breeding occurred at 100°F., whereas neither species of *Calandra* will breed in wheat at temperatures of 95°F. or more. It bred in wheat with moisture contents of 8-12 per cent.; reproduction was considerably more extensive at 9 than at 8 per cent., but increased only slightly at the higher

humidities, whereas breeding of both species of *Calandra* in wheat with moisture contents up to 14 per cent. continued to increase substantially with the moisture. The weevils breed readily in grain so moist that rapid and heavy mould growth takes place, but will not tolerate moisture contents much lower than 10 per cent. [cf. *R.A.E.*, A **30** 218], whereas samples of wheat taken from points within 1–2 ins. of where *Rhizopertha* was found breeding contained less than 8·5 per cent. moisture. Since wheat containing *R. dominica* rarely becomes mouldy [cf. **24** 194], it appears that this beetle does not raise the moisture content of grain by its activities to the same extent as do the species of *Calandra*, which have been shown to raise it by as much as 5–6 per cent. Adults of *C. oryzae* destroyed approximately their own weight of wheat in a week, but those of *R. dominica* destroyed 5–6 times their own weight in the same time.

The author discusses the present position and probable future development of *R. dominica* in Australia. It is of some importance in the wheat belts of New South Wales and Western Australia, and isolated outbreaks have been reported from Queensland, Victoria and South Australia. It was relatively unimportant until the outbreak of the war, since when it has not always been possible to clear grain showing signs of infestation or excessive heating, wheat of successive crops has overlapped in storage and it has sometimes been necessary to store wheat where infestation was already well-established. The fact that much of the wheat is handled and stored in bulk, and is therefore largely protected from substantial increases in humidity, makes it likely that *Rhizopertha* will become a much more serious pest than *Calandra*, but it should not be such a serious pest of bagged wheat as in the last war. It has been effectively controlled by fumigation in a concrete silo with Cyanogas calcium cyanide [cf. **30** 217], and recent unpublished data indicate that carbon bisulphide can be used effectively to treat localised surface infestations.

HILL (A. V.). **Yellow Dwarf of Tobacco in Australia: I. Symptoms.**—*J. Coun. sci. industr. Res. Aust.* **10** no. 3 pp. 228–230, 7 refs. Melbourne, 1937. **II. Transmission by the Jassid *Thamnotettix argentata* (Evans).**—*Op. cit.* **14** no. 3 pp. 181–186. 1941.

A description is given in the first of these papers of the symptoms of a disease of tobacco for which the name "yellow dwarf" is proposed and which has been observed in the field on varieties commonly grown in Victoria, New South Wales, South Australia and southern Queensland. The disease appears to be caused by a virus, since it is transmissible by grafting and budding. Observations suggested that it was transmitted by an insect, and this view was confirmed by investigations described in the second paper. In field experiments carried out in Victoria in 1937–38 and 1938–39, tobacco seedlings protected from insect attack by muslin cages remained healthy, whereas 13 and 43 per cent., respectively, of neighbouring unprotected plants became infected. Caged plants to which scions from diseased plants were top-grafted all developed symptoms of the disease. In 1939–40, collections were made of insects occurring in tobacco fields containing diseased plants, and seven possible vectors of the virus, including two Heteroptera, four Jassids and an Aphid, were caged with healthy and diseased tobacco seedlings and other food-plants. Each species was tested separately, and healthy tobacco plants became infected only in cages containing *Thamnotettix argentata*, Evans. Examples of this Jassid collected during a mass flight and similarly caged also transmitted the virus, and others collected at different times from various food-plants growing naturally in several localities infected healthy tobacco plants in each of 64 experiments. Both nymphs and adults, particularly those collected during November, transmitted yellow dwarf. The minimum period for the development of symptoms in plants exposed to *T. argentata* in cages or in the field was ten days.

The Jassid appears in large numbers in tobacco crops as a result of migration, induced by the drying up of the winter and early spring food-plants, usually in late November. Mortality is heavy in the absence of more suitable food-plants, and tobacco plants are, therefore, seldom infected after the spring migration is completed. Nymphs have not been found on tobacco in the field, and attempts to breed the Jassid on tobacco have been unsuccessful.

Insect Pests.—*Agric. Gaz. N.S.W.* **52** pt. 7 pp. 363–368, 6 figs.; pt. 8 pp. 430–434, 4 figs., 2 refs. Sydney, 1941.

The first of these two parts of a series on insect pests in New South Wales [cf. *R.A.E.*, A **30** 231] includes an account of a recent outbreak of *Dacus* (*Strumeta*) *ferrugineus tryoni*, Frogg., on *Citrus*, and notes on the control of *Anuraphis persicae-niger*, Smith, on peach. *A. persicae-niger* appears on the lateral growth and suckers of peach during May and early June, so that the main damage occurs on the wood that will carry the next season's crop. If infestations are noticeable early in the winter, it is advisable to apply a coarse drenching spray of 1 pint nicotine sulphate in 75 gals. water, with the addition of 6 pints white-oil emulsion or 3 lb. soft soap. The spray should be applied during the warmest part of the day, and in cases of severe infestation should be repeated after three days. Further specific spraying should not be necessary, since both tar distillate (1 : 40) and red oil (1 : 20) applied against the green peach Aphid [*Myzus persicae*, Sulz.] and San José scale [*Aspidiotus perniciosus*, Comst.], respectively, are excellent contact sprays for the control of *Anuraphis persicae-niger*, while the addition of nicotine sulphate (1 pint to 75 gals.) to the routine sprays of Bordeaux mixture or lime-sulphur applied at the bud-swell stage checks the Aphid in spring, when it multiplies rapidly. If heavy infestations still persist, a spray of 1 pint nicotine sulphate, 3 lb. soft soap and 75 gals. water should be applied immediately before full-bloom and again before the leaves begin to unfold.

During the season of 1940–41, *D. ferrugineus tryoni* attacked *Citrus* more severely than ever before in New South Wales. Passion fruit [*Passiflora edulis*] was considerably infested in the coastal districts, and infestation of commercially grown tomatoes was also reported. In some districts where considerable losses of *Citrus* occurred, January was unusually mild with numerous light falls of rain. Serious losses became evident early in February, and the percentages of fruit rejected during packing ranged from 5 to 25. In some orchards, many larvae completed their development in Valencia oranges and gave rise to adults. Infestation of late-hanging fruit does not normally exceed 1 per cent., and the young larvae are usually unable to complete their development, through failure to penetrate the inner portion of the rind (albedo) and to reach the pulp. Extensive soft water-soaked areas, which later became covered with green mould, developed round the oviposition punctures in many of the oranges; in these fruits the larvae did not develop. In addition to late-hanging Valencia oranges, intermediate and some main crop grapefruits were infested. Lemons were also heavily attacked, particularly following the Valencia harvest, but larvae were rarely found in such fruits, though oviposition punctures were common.

At this period, the fly was sufficiently abundant to threaten the main crop of navel oranges, which begin to colour in April, and a bait-spray of 2 oz. sodium fluosilicate, 2½ lb. white sugar and 4 gals. water was applied in some districts. The results appeared to be satisfactory, and losses in the main crop navels were kept to a minimum. They were further reduced by the limited development of either mould or larvae during the later part of the season.

The pests dealt with in the second part include the mite, *Tarsonemus* (*Hemitarsonemus*) *latus*, Banks, which attacked silver beet (*Beta vulgaris*) in March 1941, causing rusting of the leaves and stalks and dwarfing and distortion of the

plants, but was controlled by dusting with finely divided sulphur; and *Plutella maculipennis*, Curt., which caused severe damage to cauliflowers in February–April and was not effectively controlled, chiefly because the dusts used contained only 25 per cent. lead arsenate, which is not effective under conditions of severe infestation, and the diluent was generally hydrated lime, which has been shown to reduce the efficiency of lead arsenate in dusts.

DE ALWIS (E.). **The Paddy Pentatomid Bug** *Scotinophara (Podops) lurida* Burm.—*Trop. Agriculturist* **96** no. 4 pp. 217–220, 1 pl., 2 refs. Peradeniya, 1941.

Descriptions are given of all stages of the Pentatomid, *Scotinophara lurida*, Burm., which has been recorded from time to time on rice in Ceylon, chiefly from the south of the island, but has usually not been sufficiently numerous to be considered a pest. It breeds chiefly on rice and is also found on related grasses. There is one generation a year, and development from egg to adult lasts nearly two months. The nymphs and adults feed on the stems and are usually active during the late evening and early morning, spending the day at the base of the plants. In small numbers, they do no appreciable damage, but if numerous, they affect the vitality of the plants seriously and may kill them, particularly during the first two months of growth; older plants can resist severe attack. The adults remain inactive from harvest-time until the new crop is available next season, sheltering in the soil of the rice-fields and in neighbouring patches of high land and jungle. Control measures comprise the destruction of weeds, the erection of strong high bunds, and ploughing in the stubble at harvest, while if the bugs are numerous in the district, the rice should be watched from the third to the sixth week of growth and flooded if the bugs appear. A little kerosene added to the water increases the mortality, but the oily water must be run off after 3–6 hours. Hand collection during the fifth or sixth week, when the fields are weeded, is also recommended. The nymphs are attacked by a number of predators and the eggs by a Hymenopterous parasite.

FERNANDO (M.). **The relative Resistance of some Cowpea Varieties to** *Agromyza phaseoli* Coq.—*Trop. Agriculturist* **96** no. 4 pp. 221–224, 3 refs. Peradeniya, 1941.

Agromyza phaseoli, Coq., attacks cowpeas in Ceylon, and though it does not injure them so severely as beans, it causes considerably reduced yields. The eggs are laid within the leaves soon after the seedlings have appeared above ground, and the larvae burrow down the petiole and stem and pupate at ground level. Infested plants wilt and may die; they often show characteristic lesions near the collar, where the stem is ruptured by the crowding of larvae and pupae. Some plants recover if they are hilled up, causing the development of adventitious roots above the lesions, but they may remain unthrifty. Control is possible by the frequent application of contact sprays, but they are expensive and require skilled application.

In tests with cowpeas in 1940, the proportion of plants attacked by *A. phaseoli* was significantly lower in one variety than in two others. The characters of the three varieties and the results of the experiment are shown in tables.

IYRIBOZ (Nihat) & ILERI (Mesude). **Hububat Hastalıkları.** [Diseases of Cereals.]—*Publ. Minist. Agric. Turk. Rep.* no. 493, 174 [8] pp., text ill., many refs. Smyrna, 1941.

This bulletin comprises an account of the principal pests and diseases of cereals and stored grain in various countries, about two-thirds of it being devoted to mites and insects. The information in this section includes descriptions of the various species and suggestions for the control of many of them, chiefly of those that occur in Turkey.

NOLTE (M. C. A.). **Dinitro-ortho-cresol and other Insecticides as Locust Poisons : Experiments of 1938-39.**—*Sci. Bull. Dep. Agric. S. Afr.* no. 232, 55 pp., 45 refs. Pretoria [1941]. Price 6d.

An account is given of further investigations in South Africa in 1938-39 on substitutes for sodium arsenite in baits and of dusts and sprays for the control of *Locustana pardalina*, Wlk., and *Nomadacris septemfasciata*, Serv. The baits were tested in the laboratory on *Locustana* hoppers by the method (slightly modified) of Lea & Nolte [*R.A.E.*, A 29 613] and in field enclosures on *Nomadacris* hoppers by that of Faure & Jacot-Guillarmod [28 142]. The results showed that 5 per cent. sodium fluosilicate (the most effective), barium fluosilicate or sodium fluoride in the baits was as good as or better than 3 per cent. sodium arsenite, and that dinitro-ortho-cresols and their salts were promising in the laboratory. Cryolite, derris, thiodiphenylamine (phenothiazine) and zinc phosphide proved ineffective.

In the dusting experiments in the laboratory, hoppers or adult locusts were placed in celluloid cylinders, and the dust was slowly sifted on them, the quantity applied in most cases corresponding to a dosage of 30 lb. per acre. Several proprietary dusts, mostly containing dinitro compounds, were tested, and those in which 4.6 dinitro-ortho-cresol was the active principle proved to be highly effective against hoppers and adults of both locusts. Dusts containing 2.6 dinitro-para-cresol, however, were completely ineffective. Field experiments against hoppers of *Nomadacris* showed that the dinitro-o-cresol dusts were the most rapid in their action at a rate of 30 lb. per acre, but were as effective, though only after 7 hours, at 20 or even 10 lb. per acre. Field experiments with adults of *Nomadacris* resting on high trees, although made under adverse weather conditions (high temperatures, which caused locusts to be very active, and wind) showed that a dust containing 8 per cent. dinitro-o-cresol, 12 per cent. moisture, 35 per cent. sodium sulphate and 45 per cent. talc applied at the rate of 30 lb. per acre gave 95 per cent. mortality after 24 hours, while Detal (10 per cent. dinitro-o-cresol) gave 86 per cent. mortality. It is considered that the most satisfactory and economical method of application of the dusts would be by means of an aeroplane.

As sprays, suspensions in water of two proprietary dusts containing dinitro-o-cresol were tested and found effective at concentrations of 1-3 per cent. A 0.5 per cent. solution of potassium dinitro-o-cresylate gave 93 per cent. mortality of adults of *Nomadacris* in 48 hours, and a suspension of 1 per cent. derris root (containing 9 per cent. rotenone) killed 69.7 per cent. of *Locustana* hoppers after 96 hours.

Data on the toxicity of dinitro-o-cresol to warm-blooded animals are summarised, and it is concluded that since the dusts used in practice would probably contain not more than 10 per cent. of the active principle, the danger of acute poisoning may be estimated at about 3.3 per cent., and that of chronic poisoning at 0.33 per cent., of the danger resulting from the use of pure sodium arsenite.

LEROY (J. V.) & HENDRICKX (F. L.). **Contribution à l'étude des dégâts causés par les *Antestia* aux caféiers (*Coffea arabica* L.).**—*Centre Afrique* 1941 no. 393 repr. 1 p. [? Leopoldville] 1941.

Pentatomids of the genus *Antestia* are the most serious pests of coffee in the Kivu region of the Belgian Congo. The most obvious injury is that done to the fruit, but the authors consider that the injury to the young branches is still more serious since it renders them incapable of bearing. The bugs attack the branches when berries are not available, selecting places near the shoots. If there are many punctures near the terminal shoot, the growth of the branch is arrested and a proliferation of adventitious shoots that do not put forth normal

blossoms results. As a rule, injury to the fruit becomes apparent only at harvest, when the loss of the still milky endosperm results in deformed and more or less empty seeds. The bugs may also infect the fruits with *Nematospora coryli* and possibly *N. (Ashbya) gossypii*, and one of the authors has isolated fungi of the genera *Pestalozzia* and *Mucor* from their mouth-parts. The cracks that sometimes appear on green fruits are apparently due to *Antestia*; they may afford entrance to saprophytic fungi, and usually both seeds in such fruits are destroyed. In some plantations, coffee-berries fall to the ground, having become detached from the stalk at its point of insertion, where a necrosis develops. In experiments such fallen berries were found in cages containing *Antestia*, but not in cages free from insects or in cages containing Capsids of the genus *Lygus*.

MILES (H. W.) & COHEN (M.). **Investigations on Wireworms and their Control. Report for the Years 1939 and 1940.**—*J. Lancs. agric. Soc.* 1941 repr. 31 pp., 10 figs., 4 refs. Preston, 1941.

An account is given of continued investigations, made during 1939 and 1940, at Warburton (Cheshire), on the bionomics and control of wireworms [cf. *R.A.E.*, A 28 234]. In both years, the numbers of adults of *Agriotes obscurus*, L., caught in traps were fairly closely related to the weather and were lowest when it was warm and dry. Few were trapped on paths and fallow land; they were most numerous in fields under grass or cereals, which, in addition to providing cover, keep the air moist at the surface of the soil. Temperature and moisture are therefore assumed to be the principal factors influencing oviposition. In 1939, adults taken in the field oviposited on 9th May, and those that had overwintered in the laboratory did not lay eggs earlier than this. Oviposition was last observed on 14th June, and is thought to continue normally for about a month in north-western England. Peak oviposition, which lasted about 7 days, occurred in the third week in May. The numbers of eggs laid by females in the laboratory varied from 78 to 186 and averaged 109. Of a total of 5,000–6,000 eggs, two-thirds hatched after 35–39 days, the extreme incubation periods being 29 and 51 days. The adults are short-lived. Dead males were first found during the first week of June, and dead females were most abundant between 23rd and 27th June; the last female in the breeding tubes died on 5th July. The larvae moulted a month after hatching, and most moulted again in October, after which there was one ecdysis a year.

Only seven adults of *A. lineatus*, L., of which three were females, were collected in 1939. Eggs were laid between 10th May and 3rd June, and hatched in 30–52 days, the majority hatching in 30–39 days. The newly-hatched larvae moulted in July and again in October. A few adults of *A. sputator*, L., which in some districts is as common as *A. obscurus* and causes considerable injury, were observed near Chester in 1940, and observations were made on about 130 collected in Wiltshire in April 1939. Oviposition continued from 10th May until 1st June, and the incubation period lasted 35–46 days.

Characters are given distinguishing the larvae of *A. sputator* from those of *A. obscurus* and *A. lineatus*, which are indistinguishable from each other. The larvae of all three species are equally injurious, and, when 18–20 months old, are large enough to cause considerable destruction of crops. Further observations on the vertical migration of larvae of *A. obscurus* in the soil confirmed the occurrence of definite seasonal movements [27 96], and figures are given showing the proportion of larvae found at various soil levels in arable land at different seasons during 1937–39. These movements appear to be less pronounced in permanent grassland, where the larvae often occur only in the turf layer, even when this is frozen. The larvae become prepupae about mid-July, and the pupal stage begins during the latter part of the month and is generally

completed by mid-September ; the adults remain in their pupal cells until the following spring. Over 75 per cent. of the pupae occur within 6 ins. of the surface, most of them at a depth of 3-4 ins.

Parasitised larvae of *A. obscurus* have occasionally been found in Lancashire and Cheshire, but less than a dozen of the thousands of larvae examined during 1937-40 were recognisably parasitised. Specimens of one parasite bred towards the end of 1938 were determined as the Proctotrupid, *Paracodrus apterygynus*, Hal. The process of oviposition, which takes place through the inter-segmental membrane of the host larvae, is described. Some months after oviposition, several parasite larvae were found in the body cavities of dissected host larvae, which appeared to be unaffected by the presence of the parasites. Shortly before the latter become fully grown, they consume the vital organs of the host, and bite through its under surface ; they pupate in this position and the pupae protrude through the hole but remain attached to the host. Three adults of *A. obscurus* were parasitised by an unidentified Nematode.

The size of wireworm populations in permanent grassland varied considerably, even in different parts of the same field, and in 1937-38, populations ranging from 160,000 to 880,000 per acre occurred in 13 representative fields in Lancashire and Cheshire, high populations being found in heavy and medium loams as well as in lighter types of soil. During 1939-40, the populations in 40 fields under grass that were widely distributed throughout the two counties and were to be ploughed for cropping were estimated from 20 samples, each comprising a 6-in. cube of soil, taken from each field. In general, the range was from 50,000 to 300,000 per acre ; populations exceeded 250,000 in 27.5 per cent. of the fields and were less than 100,000 in about 33 per cent. From observations made on the growing crops in these fields, it was concluded that cereals are unlikely to be seriously injured where wireworm populations do not exceed 250,000 per acre, partial failure in these circumstances being in general due to other causes. Where all other conditions are favourable, populations as high as 250,000-500,000 per acre are not injurious, but where populations exceed 500,000, cereal crops, with the exception of late barley, may fail completely. Potatoes may be severely injured by populations above 50,000 per acre, although early varieties may escape serious injury even where populations are 3 times as high. Forage crops were grown in only three fields, all with populations below 100,000 per acre, and the yields were satisfactory.

The four soil treatments [28 236] were again tested on plots bearing five main-crop varieties of potato and had no deleterious effect on yield, but no treatment gave consistently good results in reducing the percentage injury by wireworms. The population indices for spring and for the following autumn in plots receiving each treatment are given in a table. In general, populations had decreased by autumn, but this effect could not be directly associated with the treatments. There was no constant relation between the degree of injury and the density of the initial infestation, although there was a tendency for the greatest injury to be associated with higher populations ; the percentage injury to the tubers was not directly associated with the number of larvae present after the crop was lifted.

Observations on the susceptibility to attack of four early, four second early and four main-crop varieties of potato were continued [*cf.* 28 236], and the percentage injury sustained by each variety during 1938, 1939 and 1940 are given in a table. Differences in susceptibility were not constant, and considerable difficulty was experienced in measuring the degree of attack. The amount of injury varied greatly from week to week both within and between the varieties. On the whole, the early, second early and main-crop varieties that appeared to sustain least injury during the three years were Duke of York, Great Scot and King Edward, respectively.

Asparagus, chicory, flax, peas, parsnips, red beet, radish, and seedling sugar beet and swedes were not injured by wireworms during either year, and injury

to Jerusalem artichokes [*Helianthus tuberosus*], Dutch beans, carrots, leeks and onions was negligible. Of cabbage and cauliflower plants, about 30 per cent. were attacked in 1939, but no loss could be attributed to wireworms. About 8 per cent. of both cos and cabbage lettuce were destroyed in 1939 [cf. 28 236], and of swede plants that had passed the seedling stage, 10 per cent. were attacked.

OSSOWSKI (L.). **The Pine Shoot Beetles.**—*Scot. For. J.* 55 pt. 2 pp. 75–79. Edinburgh, 1941.

The author briefly describes the damage caused to pine trees by the adults of *Myelophilus piniperda*, L., and *M. minor*, Htg., which hollow out the shoots and cause them to break off, and features by which the breeding galleries of the two species in the bark can be distinguished. In spite of natural control by birds and predacious insects [R.A.E., A 28 410; 30 29], *Myelophilus* and other Scolytids are numerous and injurious in woods in Scotland, largely owing to the presence of plantations consisting of trees of the same age and of the same species, which are more susceptible to destructive insects than mixed plantations and trees of different ages. On the basis of experience in Poland, the author recommends that instead of consisting entirely of equal numbers of Scots pine [*Pinus sylvestris*], European larch [*Larix decidua*] and Norway spruce [*Picea abies*], each plantation should contain 30–50 per cent. of non-coniferous trees; that in conifer plantations, all unhealthy trees and fallen wood should be removed; and that trap trees should be used for direct control. Standing trap trees should be prepared in late autumn, by removing the bark from slightly unhealthy trees for about two yards from the roots; this causes a greater flow of resin, weakens the trees and attracts the beetles. In spring, after the flight period, the trees should be examined for tunnels containing larvae and felled and barked if they are infested. The bark should be burnt or buried. Lying trap trees should be placed on blocks in sunny positions at the end of February or the beginning of March and inspected for attack in April. When larvae are present, the bark should be stripped and bunt. The number of trap trees used should depend on the severity of the infestation; suggested rates for coniferous forests of various ages are given. Any felled wood left in the forest after 1st March should be barked.

DAVIAULT (L.). **La mouche à scie européenne de l'épinette dans les forêts du Nord du St.-Laurent.**—*Forêt québécoise* 3 no. 7 pp. 12–16, 7 refs. Quebec, 1941.

An account is given of a survey made in 1940 to ascertain the injury done to spruce by the European spruce sawfly [*Gilpinia polytoma*, Htg.] and the efficiency of its parasites in the region of Quebec north of the St. Lawrence. An increase in the severity of infestation was observed to the north-east of the city of Quebec, but in general the forests most severely affected are not at present of great commercial value. There was little mortality of young trees. Small mammals constituted the chief natural enemies, and in some populations over 80 per cent. of the cocoons examined had been opened by them. Few native parasites had adapted themselves to the sawfly. Those found were the Tachinid, *Phorocera hamata*, Aldr. & Webber, the Ichneumonid, *Spilocryptus* (*Agrothereutes*) *slossonae*, Cushman, and an unidentified Hymenopterous parasite, but none of them was numerous. It is too early to assess the importance of the imported European parasites, but *Microplectron fuscipenne*, Zett., has become established in several places. Up to 10 per cent. of the larvae in many of the localities visited had been killed by the virus disease that has been observed in the Gaspé Peninsula and New England [cf. R.A.E., A 29 531].

HARTZELL (A.) & McKENNA (G. F.). **Preliminary Experiments on the Control of the Holly Leaf Miner.**—*Contr. Boyce Thompson Inst.* **12** no. 2 pp. 119–126, 1 fig., 7 refs. Menasha, Wis., 1941.

An account is given of experiments carried out in New York with dusts in 1938 and sprays in 1938–40 for the control of the holly leaf miner, *Phytomyza ilicicola*, Lw., which is the most serious pest of holly (*Ilex opaca*) in eastern North America. The results obtained in the first two years were not promising, but in 1940, a spray containing nicotine sulphate and fish oil (1 : 2 : 400), applied to the foliage on 10th and 17th May, 14th June and 17th July, reduced the numbers of mines by 91 per cent. as compared with untreated foliage in randomised field plots. The addition of 4 lb. lead arsenate per 100 U.S. gals. did not improve the control. Four applications in May and June of 1 pint Textac (a proprietary spreading agent consisting of diethylene glycol diacetate) per 100 gals., with the addition on the last date of Aerosol OT (a proprietary spreader consisting of a 10 per cent. aqueous dioctyl ester of sodium sulphosuccinate and stated in a footnote to be identical with Vatsol OT) at 1 : 1,000 gave considerable control, which was reduced by the addition of lead arsenate. The application on 3rd June of a spray containing Aerosol OT (1 : 1,000), lead arsenate (2½ lb. per 100 U.S. gals.) and nicotine sulphate (1 : 400) to eight holly trees 10–12 ft. high and with a 6-foot spread at the base reduced the numbers of mines by 95 per cent. Only the sprays containing Textac caused injury to the foliage. It is concluded that foliage protected by sprays of fish oil and nicotine sulphate during the period in which the flies are present in the field tends to be relatively free from mines.

There seemed to be no correlation between the number of oviposition punctures in the leaves and the number of mines. During a season in which temperature and rainfall were normal, the adults appeared about the middle of May, but in a late season, they were not observed until the first week in June.

HARTZELL (A.) & WILCOXON (Fredericka). **A Survey of Plant Products for Insecticidal Properties.**—*Contr. Boyce Thompson Inst.* **12** no. 2 pp. 127–141, 1 fig., 35 refs. Menasha, Wis., 1941.

The authors describe experiments in which water and acetone extracts of products of 36 out of 150 species and varieties of plants, lists of which are given, gave 50–100 per cent. mortality of larvae of *Culex fatigans*, Wied. (*quinquefasciatus*, auct.). Some of them also proved toxic as contact insecticides to *Aphis rumicis*, L. In a discussion of the results, it is stated that one of the objects of the investigation was to reveal chemical groups that possess insecticidal properties. Many of the plants tested contain terpenes known to be potent insecticides, but filicin, a toxic constituent of male fern (*Aspidium filix-mas*) [cf. R.A.E., A **28** 515], is a phloroglucinol propyl ketone, and the active principle of elecampane (*Inula helenium*) is helenin. In the case of pumpkin (seed) and a number of other plants with insecticidal properties, the active principle is not known. There appears to be no correlation between botanical classification and toxicity to insects. Water and acetone extracts do not necessarily remove the toxic principle from plant products, but acetone was found to be the better solvent of the two. The fact that a plant extract is toxic to mosquito larvae does not necessarily indicate that it possesses marked toxicity to insects of other species. For example, an acetone extract of the buds of balm of Gilead (*Populus* sp.) is toxic to mosquito larvae, but possesses little or no toxicity to *Aphis rumicis*, whereas filicin possesses a toxicity comparable with that of pyrethrum to mosquito larvae, *A. rumicis* and house-flies (*Musca domestica*, L.). None of the plant products tested caused injury to

plants, and none of the limited number tested on grasshopper nymphs showed promise as stomach poisons.

STEINER (H. M.) & WORTHLEY (H. N.). **The Pistol Case-bearer and its Control in Pennsylvania Orchards.**—*Bull. Pa agric. Exp. Sta.* no. 406, 26 pp., 9 figs., 9 refs. State College, Pa., 1941.

The following is based on the authors' summary. *Coleophora malivorella*, Ril., is primarily a pest of apples, but has also been observed on quince, pear, plum, cherry and wild cherry in Pennsylvania. It is usually controlled by natural means, but has been very injurious in scattered orchards in eastern Canada and the United States, particularly in the Cumberland-Shenandoah fruit belt of Virginia, West Virginia, Maryland and Pennsylvania.

This Tineid has one complete generation in the year, and overwinters as a partly grown larva within a pistol-shaped case attached to a twig or fruit spur. The most extensive damage is caused by the overwintered larvae, which injure buds, blossoms, foliage and fruit. Trees are sometimes almost completely defoliated, particularly those of late-leaving varieties, and the fruit crop may be completely destroyed [cf. *R.A.E.*, A **23** 219]. The larvae pupate within their cases in late May and June, and the moths emerge in June and July. Most of the eggs are laid on the upper leaf surfaces within 2–5 days of adult emergence. The larvae, which hatch in 11–20 days, eat their way through the bases of the eggs and the leaves and emerge on the lower surfaces into protecting cases that they construct from silk and leaf tissue. They then feed for a time, making pin-holes in the leaves, and enter hibernation between late August and late October. Natural conditions unfavourable to the development of outbreaks of *C. malivorella* are low maximum temperatures during the oviposition period, thin or light green foliage on the trees at this time, and natural enemies, chiefly parasitic and predacious insects [cf. **29** 363]. A list is given of parasites that have been reared in Pennsylvania; they comprise a Tachinid bred from pupae and 12 Hymenoptera that attack the larvae, of which the Pteromalids, *Eurydinota lividicorpus*, Gir., and *Habrocytus phycidis*, Ashm., were the most numerous. Two Capsids, *Diaphnidia pellucida*, Uhl., and *Hyaliodes vitripennis*, Say, have been observed feeding on the larvae at various seasons, but their value in control is not known.

Spraying experiments showed that while thorough application of a complete schedule of lead-arsenate sprays prevents the insect from attaining dangerous numbers, other measures are preferable to control an outbreak. For this purpose, the efficacy of mid-summer sprays of nicotine sulphate and oil or Penetrol [cf. **17** 715] is confirmed [cf. **23** 219], but there are certain drawbacks to their use, since the necessary applications do not fit in with the usual schedule of sprays on apple, the use of oil with nicotine sulphate may result in injury to the foliage if sulphur residues persist from earlier sprays, thorough coverage is difficult to obtain when the trees are in full foliage, and the sprays require special timing, based on careful records of the seasonal development of the insect. Two early applications of cubé powder in the usual spray mixtures killed more than 95 per cent. of the larvae, and the authors recommend that a spray containing liquid lime-sulphur for disease control, 3 lb. cubé powder (5 per cent. rotenone) and 3 U.S. gals. lubricating oil emulsified with $\frac{1}{2}$ lb. sulphite lye (Goulac) per 100 U.S. gals. spray, applied at the delayed dormant stage, should be followed at the pink stage by one of 6 lb. wettable sulphur and 3 lb. cubé per 100 U.S. gals. spray, to which half an ounce of a product (Anti-foam no. 16) consisting of 60 per cent. wool-grease emulsion and 40 per cent. naphtha has been added in order to prevent foaming when the spray is agitated to keep the cubé powder in suspension. Satisfactory control of the European red mite [*Paratetranychus pilosus*, C. & F.] and the rosy apple aphid [*Anuraphis roseus*, Baker] resulted when cubé was used with oil in the delayed dormant spray.

HUBER (L. L.). **Learning to live with the European Corn Borer.**—*Bi-m. Bull. Ohio agric. Exp. Sta.* **26** no. 210 pp. 87–104, 19 figs. Wooster, Ohio, 1941.

The population of *Pyrausta nubilalis*, Hb., on maize appears to have increased in general during the last few years in north-western Ohio, where most of the eggs are laid on this food-plant and oviposition occurs about the first week in July. The abundance of *P. nubilalis* and the degree of damage it causes are influenced by many environmental factors, of which the most important are the height of the plant when the eggs are deposited, temperature, rainfall, soil fertility and farm management. The most effective methods of preventing severe damage to maize are the development of late hybrids that are less susceptible and more tolerant to attack by the borer than the open-pollinated varieties [cf. *R.A.E.*, A **26** 505] and the avoidance of abnormally early planting on the more productive soils [cf. **25** 542].

KIPLINGER (D. C.) & LAURIE (A.). **The Effects of several Spray Materials on the apparent Photosynthesis of the Greenhouse Rose.**—*Bi-m. Bull. Ohio agric. Exp. Sta.* **26** no. 210 pp. 105–119, 7 figs., 19 refs. Wooster, Ohio, 1941.

The following is based on the authors' discussion and summary. Data are presented to show the effect of several materials used in sprays on the rate of apparent photosynthesis of the rose "Better Times." The materials tested comprised soap, oil and combinations of rotenone and oil, rotenone and glycerol, rotenone, pyrethrum and oil, and pyrethrum and soap, and all the sprays caused an immediate reduction from the expected rate, the degree of which varied with their composition. The oil or soap fractions of the materials caused a considerable proportion of the decrease. No injury was visible in any of the experiments, though in greenhouses in which frequent spraying is necessary, a definite check in growth is not uncommon. The decrease in the apparent photosynthetic rate was not correlated with flower production, but this phase is being investigated.

JONES (H. A.) & HALLER (H. L.). **Composition of Geraniol for Japanese Beetle Bait.**—*News Edit. Amer. chem. Soc.* **19** pp. 683–685, 13 refs. Easton, Pa., 1941.

In view of the variation in attractiveness to adults of the Japanese beetle [*Popillia japonica*, Newm.] of commercial geraniols meeting the specified requirements for use in traps for them [cf. *R.A.E.*, A **24** 303–304 ; **29** 126], a detailed study of the chemical composition of one sample is reported.

CALHOUN (P. W.). **Topping Cotton in early Fall as a possible Means of reducing the Spring Boll Weevil Population in the northwestern Part of the Florida Sea Island Cotton Belt.**—*Florida Ent.* **24** no. 2 pp. 35–40, 5 refs. Gainesville, Fla., 1941.

The investigations described were carried out in view of the exceptionally large numbers of boll weevils [*Anthonomus grandis*, Boh.] that develop in autumn in cotton bolls in the upper parts of the plants in the north-western part of the Florida Sea Island cotton belt. These populations commonly exceed 10,000 weevils per acre, and control is so difficult that the growing of Sea Island cotton on a large scale generally has to be abandoned. An experiment was made in the autumn of 1940 over some 200 acres of heavily infested cotton ; most of the fields had produced less than half their crop. Almost all the bolls on the upper half of the plants contained 2–5 larvae or pupae, while the tops were producing an abundance of squares. The plants were topped on 10th September, about 10 days before the final picking ; the upper parts (about one-third of each plant) that contained bolls severely infested with

advanced-stage larvae or pupae were cut off, in order to destroy as much of the squaring portion as possible without discarding any sound bolls. As soon as the discarded tops died, the adult weevils feeding on them moved back to the plants, and fed on the few remaining squares and on bolls that were not ready to open. As the population had already been high for several weeks, nearly all the sound bolls were tough, fibrous and almost ready to open. About two weeks after topping, the adult weevils began to decrease in numbers, until only a few remained. Whether most of them died or migrated is not known. The immature stages died in great numbers in the young bolls on the removed tops, and the percentage emergence was much lower than it would have been had the tops remained on the plants. The bolls on the living plants that had been attacked, but not completely ruined, by the weevils apparently opened more quickly and fully as a result of topping, which seemed to result in less waste cotton being left in the field at the final picking. It is thought that the cost of the operation was more than covered by the increase in the amount of the cotton harvested.

Data are reviewed from the literature indicating that an abundance of squares and blossoms in autumn increases the weevils' chance of surviving the winter, and original observations are recorded, which showed that newly emerged weevils fed on young cotton leaves, mature green leaves or squares all gained equally in weight, but that those fed on squares did so more rapidly; it was considered that the weevils that fed on leaves could not have oviposited normally. When adults taken in the field were given moisture but not food, very few survived for more than a few days after losing 20 per cent. of their weight; the loss of weight was generally slow and regular until 2 or 3 days before death, when it became irregular and rapid.

If an abundance of squares in autumn helps the weevil to survive the winter, the scarcity of squares in the fields that have been topped will decrease the percentage survival of the relatively few weevils that remain, and so increase the effect of the reduction in the population caused by the topping. If practised co-operatively on a sufficiently extensive scale, topping should thus prevent the occurrence of the heavy spring populations that are common in the north-western part of the Florida Sea Island cotton belt. It is not recommended for the central and southern parts of this belt, however, as the same result can be better obtained there by early picking followed by prompt destruction of the stalks.

WATSON (J. R.). **Migrations and Food Preferences of the Lubberly Locust.**—*Florida Ent.* **24** no. 2 pp. 40–42. Gainesville, Fla., 1941.

Further observations in Florida are recorded showing that hoppers of the lubberly locust [*Romalea microptera*, P. de B.] migrated in 1940 from the breeding grounds to a field of narcissus, although the field was not in the same direction as in the preceding year [cf. *R.A.E.*, A **28** 542]. Almost all had left the breeding ground within a week of hatching. In feeding experiments, narcissus was much more favourable for development than a number of weeds and was preferred to them. A ditch a foot deep with steep straight sides made an effective barrier against the migrating hoppers. Some of the main breeding grounds were burned over during the time of active hatching, with a very marked effect on the numbers of hoppers, but they hatch too irregularly for burning to be a completely effective means of control.

SORENSEN (C. J.) & THORNLEY (H. F.). **The Pale Western Cutworm (*Agrotis orthogonia* Morrison) in Utah.**—*Bull. Utah agric. Exp. Sta.* no. 297, 23 pp., 8 figs., 13 refs. Logan, Utah, 1941.

Agrotis orthogonia, Morr., causes periodic damage to wheat on dry-land farms in Utah, and this bulletin comprises an account, based largely on investigations

carried out between 1936 and 1940, of its bionomics and control. Its distribution in the United States and Canada is given, and all stages are described. The larvae were found feeding on winter and spring wheat, oats, barley, maize, Sudan grass [*Sorghum sudanense*], beans, lucerne, potatoes, tomatoes and various weeds, a list of which is given, but the injury to winter wheat is particularly severe. The larvae hatch in early spring and feed on the stems of the plants just below the surface of the soil. Each larva thus attacks many plants in succession, and the injured plants wilt and eventually die. Damage is first noticeable on sandy spots about 1st May, and if infestation is heavy, large bare patches appear in a fortnight. Extensive and serious damage is caused by 1st June.

The larvae remain below ground except for a short period after hatching and during heavy rainfall, and are fully-grown by the beginning of June, when they enter the prepupal stage and aestivate. The earthen cell in which the prepupal and pupal stages are passed is usually constructed 3-5 ins. below the surface of the soil. Pupation occurs in August and the adults emerge in September and October. They are chiefly active in the evening and the warmer part of the night, when the temperature is over 45°F. In the area under investigation, their food consisted almost entirely of the nectar of rabbit-brush (*Chrysothamnus*) [cf. R.A.E., A 18 622]. Eggs are deposited in loose soil in cultivated fields and in sandy patches in wheat fields and on uncultivated land. The moths did not live long in the laboratory, and oviposition in the field was practically completed by mid-October. Males represented 66 per cent. of the moths reared in the laboratory and 77 per cent. of over 36,000 caught in light-traps.

Summer fallowing was the most effective control measure tested in Utah. The land should be ploughed in early May, when the young larvae have begun to feed and so cannot resist starvation [cf. 25 754-755] and should be kept clear of weeds until 1st August. It should then be left completely undisturbed, as this allows the formation of a surface crust that prevents the moths from laying eggs in the soil. It was observed that such a crust would form even in the absence of rain [cf. 23 540]. In June 1936, infested fields under potatoes and maize were thoroughly irrigated, after which many dead and dying larvae were seen on the ground and further damage was negligible. Experiments indicated that light-traps are impracticable as a means of control. Weather is the most important natural factor influencing the abundance of *A. orthogonia*; wet, cold storms during the oviposition period seriously interfere with egg-laying, and a rainy spring causes heavy mortality of the larvae. Spiders and predacious insects, including a Mantid and three Heteroptera, were observed attacking the adults at flowers of *Chrysothamnus*, and birds feed on the larvae. One adult of *Gonia longiforceps*, Toth., and several of a species closely allied to *G. aldrichi*, Toth., emerged from puparia dissected from dead pupae of *A. orthogonia*; and nine adults of *Linnaemyia* (*Bonnetia*) *comta*, Fall., which has previously been recorded as a parasite of the larvae, were found in a cage in which larvae were being reared. These natural enemies afford little control, but certain diseases caused by undetermined bacteria or fungi result in considerable mortality among the larvae, especially after heavy rain.

COTTON (R. T.) & WINBURN (T. F.). **Field Infestation of Wheat by Insects attacking it in Farm Storage.**—*J. Kans. ent. Soc.* 14 no. 1 pp. 12-16. Manhattan, Kans., 1941.

In view of reports that infestation of farm-stored wheat by insects in the Mississippi, Missouri and Ohio valleys was the most severe for 20 years, investigations were carried out in 1938 and 1939 to discover whether this infestation could have begun in the field. Samples of wheat heads were collected in May and June 1939, when the grain was still immature and

had a high moisture content, from fields in Texas, Oklahoma, Kansas and Missouri, and records of all insects emerging were made. Most of them were scavengers; the two most abundant were *Ahasverus advena*, Waltl, and *Typhaea stercorea*, L., which are also very common in maize fields, particularly on the tips of ears where rotting of the kernels occurs. The true pests of stored grain rarely occurred; *Calandra* (*Sitophilus*) *oryzae*, L., was reared from one sample taken in Kansas, but not from the other States, although adults of this weevil were observed on wheat heads in the field in Texas at the time of collection. *Sitotroga cerealella*, Ol., emerged from wheat heads from Texas and Missouri. The occurrence of Dermestids in some of the samples may have been due to contamination while in storage, although Dermestids have been observed on wheat heads in the field. Of a further 150 samples collected in western Missouri and Kansas in June and July, when the wheat was mature, only 11 yielded insects. In no case was *C. oryzae* or *S. cerealella* present, and the insects found in about half the samples were not pests of grain and were probably associated with the wheat heads accidentally. Records of all the species obtained are given in tables.

Examination of maize in the field, in the autumn of 1938, showed some infestation by *C. oryzae* and *S. cerealella* in Kansas, Oklahoma, Missouri and Illinois. The weevil is not resistant to low temperatures, and it was found in November to have been killed by cold in maize in Kansas and Missouri. The practice of storing maize in slatted cribs exposed to the cold probably prevents *C. oryzae* from overwintering in it in these States. *Sitotroga* survived the winter of 1938-39 to some extent, and infestation by it caused considerable damage in 1939 to unshelled maize in the southern portions of these States. It is concluded from the investigations that the heavy infestations of farm-stored grain are unlikely to have begun in the field.

WINBURN (T. F.). **Insect Infestation in Railway Box Cars in which Wheat has been shipped.**—*J. Kans. ent. Soc.* **14** no. 1 pp. 22-25. Manhattan, Kans., 1941.

During a study in the summer of 1939 of the insect populations of empty railway vans that had been used for transporting grain in Kansas and Missouri, it was found that about 50 per cent. of the vans were lightly infested with insects in June, and that the majority were heavily infested in July. The results of the examinations are shown in tables; in all, 15 species of insects were taken, and as many as 153 examples occurred in a single van after the peak of the grain-carrying season.

CURTISS (C.). **The Alfalfa Plant Bug, *Adelphocoris lineolatus* (Goeze), found in Kansas.**—*J. Kans. ent. Soc.* **14** no. 1 pp. 25-26, 7 refs. Manhattan, Kans., 1941.

Adelphocoris lineolatus, Goeze, which was recorded for the first time in the United States in Iowa in 1929 [*R.A.E.*, A **18** 273], was taken on lucerne at Manhattan, Kansas, in August 1939. This Capsid is a pest of lucerne and cotton in the Russian Union [**3** 479; **12** 556; **23** 616] and is likely to cause considerable damage to clover and lucerne should it become abundant in Kansas. It has been recorded from chrysanthemum, onion and beet in Britain [**3** 747].

BRYSON (H. R.). **The Occurrence in Kansas of the Sugar-cane Rootstock Weevil, *Anacetrinus deplanatus* Csy. (Coleoptera, Curculionidae).**—*J. Kans. ent. Soc.* **14** no. 3 pp. 84-90, 1 fig., 6 refs. Manhattan, Kans., 1941.

Anacetrinus deplanatus, Csy., attacked several varieties of sorghum and caused severe injury to one of them in a nursery at Manhattan, Kansas, in 1939,

and was found infesting barnyard grass (*Echinochloa crus-galli*) near the nursery and elsewhere in Kansas in 1939 and 1940. Maize near infested barnyard grass was not attacked. The distribution of the weevil and its food-plants are reviewed [cf. *R.A.E.*, A 20 589, 590 ; 30 56]. The chief damage to sorghum was caused by the larvae tunnelling in the base of the stalks ; the roots were also occasionally injured. The larvae did not migrate from one cavity to another, but consumed the tissues as they progressed. The leaves withered from the base upwards, and the seeds were undersized and shrivelled. An infestation of four or more larvae destroyed the tissues to such an extent that very little seed was produced, and the stems were so weak that they lodged easily, or broke off at the surface. Injury was apparent from mid-July until harvest, but most of it had been done before mid-July. It is evident that *A. deplanatus* is capable of causing severe damage even when present in relatively small numbers, and a watch should be kept for it so that control measures may be developed.

Sorghum is relatively free from injurious insects in Kansas ; the development of Atlas sorgho, which is resistant to injury by the chinch bug [*Blissus leucopterus*, Say], has made possible the extensive use of this valuable grain and forage crop even in the eastern and south-eastern part of the State where *B. leucopterus* is normally abundant. Of the other insects that attack sorghum in Kansas, the most important are *Solenopsis molesta*, Say, *Aphis maidis*, Fitch, and *Heliothis armigera*, Hb.

University of Puerto Rico Agricultural Experiment Station. Annual Report(s) for the Fiscal Year(s) 1937-38, 1938-39, 1939-40.—[4] 114 pp., 1 pl., 14 figs. ; xiii, 102 pp., 22 figs. ; vii, 66 pp., 11 figs. S. Juan, P.R., 1939 ; Río Piedras, P.R. [1940-41.]

Some of the information contained in these reports of the work done on insect pests and their control in Porto Rico during 1937-38, 1938-39 and 1939-40 has already been noticed from other sources [*R.A.E.*, A 27 424 ; 28 630 ; 29 157, 553 ; etc.]. Liberations of *Rodolia cardinalis*, Muls., in districts (including Mona Island) where *Icerya purchasi*, Mask., was abundant in *Citrus* groves and on *Casuarina* were continued [cf. 27 434]. In March 1940, a shipment of *Cryptochetum iceryae*, Will., which parasitises *I. purchasi*, was received from California and releases were made on Mona Island and in Porto Rico. Continued investigations on the resistance of building materials to *Kaloterms* (*Cryptotermes*) *brevis*, Wlk., showed in 1939-40 that wall-boards with a hard coating on the outside, even if it consisted only of heavy glazed paper, were not attacked through the coating. Termites attempting to establish colonies in stacks of magazines with glazed paper invariably die. They preferred wall-board made from sugar-cane bagasse to one having a wooden base, but ate little of it and gradually died ; untreated pressed bagasse was readily eaten and had no injurious effect. The resistance of lignin plastics varied, and it was apparently due to some element other than lignin.

During 1937-38, commercial miscible-oil sprays gave incomplete control of heavy infestations of *Aulacaspis* (*Diaspis*) *pentagona*, Targ., and *Pseudoparlatoria ostreata*, Ckll., on papaya, whereas over 99 per cent. control was obtained on trees that were later sprayed with water alone at a pressure of 300 lb.

Outbreaks of *Sipha flava*, Forbes, on sugar-cane have decreased, chiefly owing to the extended use of more resistant varieties and partly to natural control by parasites, predators, and heavy rainfall. An experiment in December 1937 indicated that dusting with Cyanogas calcium cyanide is a promising treatment for control of a heavy infestation when natural enemies are scarce. In order to supplement natural parasitism of the eggs of *Diatraea saccharalis*, F., by *Trichogramma minutum*, Ril., series of liberations of a xerophytic strain

of the parasite were made in irrigated sugar-cane fields in three districts in 1937-38. The parasite failed to become established in two, owing to wet weather at the time of release, but 100 per cent. parasitism was recorded in each of two fields in the third district. Wet weather at the time of release delayed establishment in one of these fields; in the other, liberations were made during dry weather, and parasitism reached 100 per cent. after only two releases, but natural parasitism in neighbouring fields was as high as 68 per cent. only one week later. Attempts during the years under review to confirm the correlation previously observed between rainfall, egg-production by *Diatraea* and parasitism by *T. minutum* [27 436] were unsuccessful; but in 1940, egg-production and percentage parasitism appeared in some localities to be correlated with weekly maximum and minimum temperatures.

Approximately 2,000 adults of *Mirax insularis*, Mues., the Braconid parasite of *Leucoptera coffeella*, Guér., observed in Guadeloupe in 1936 [27 435], were reared from a consignment received from that Island in August 1937 and released in coffee groves in five places in Porto Rico. Recoveries were made repeatedly in two places until October-November 1938; they then ceased, owing to the seasonal scarcity of the host larvae, but began again in May, when the host larvae became more abundant. Eight or nine generations of the parasite were thought to have occurred by May 1938, and the percentage of larvae parasitised by it had increased to 9.3 by November 1939. The parasite is now considered to be definitely established and able to survive the seasonal scarcity of its host as it does in Guadeloupe, where it attacks 50-66 per cent. of the larvae of *L. coffeella*. Parasitism by native species averaged only 15 per cent. in 1937-38 and 1938-39. The most abundant species in 1938-39 were *Euderus (Chrysocharis) lividus*, Ashm., *Closterocerus leucopus*, Ashm., and *Horismenus cupreus*, Ashm. *Tyroglyphus lintneri*, Osb., *Pediculoides* sp. and two other mites were observed for the first time in 1937-38 in empty mines of *L. coffeella* or attacking the larvae; these mites are not normally abundant, but may have been responsible for the failure of *M. insularis* to become established at one place where it was released. Further evidence of the correlation between low relative humidity and increased infestation by *L. coffeella* [27 435] was obtained during 1937-38 and 1938-39. Attempts in 1937-38 to increase the relative humidity of a coffee grove by means of wind-breaks 6 ft. high were unsuccessful, even when the height of the wind-break was increased to 12 ft. on the windward side. In experiments, adults were released in numbers in humid groves at all seasons of the year, but always left them immediately, without ovipositing. When potted plants from a humid grove were placed in a drier situation, they were defoliated by the larvae, but when they were returned to the grove, the new leaves that opened were uninfested and remained so. When plants of an Arabian coffee, *Coffea stenophylla*, that was observed to be uninfested in the field were potted and placed in the greenhouse during 1939-40, eggs were deposited on the leaves, but the larvae died at various stages of penetration and none survived long enough to cause any appreciable damage.

A bait of beef, salt pork, codfish and thallium acetate [cf. 26 223; 27 435] tested on a large scale in March-April 1938 for the control of *Myrmelachista ramulorum*, Wheel., on coffee shade-trees was ineffective, as were also baits of finely minced steak and salt pork containing strychnine sulphate, sodium arsenate or potassium arsenate applied directly to the rough bark of infested trees in November 1938 and March 1939. In tests in the third year under review, unpoisoned meat was placed in small metal tubes, in one side of which two slits extending down half the length were made so that the inside could be roughened to enable the meat to adhere, and the tubes were fastened to the bark. Ants collected at the meat in numbers, and attempts were then made to destroy them with three fumigants. Of these, Cyanogas calcium cyanide was immediately effective, potassium cyanide, used alone or mixed with meat, took effect more slowly, and paradichlorobenzene had no effect.

Two undescribed species of *Acrocercops* (*Neurostrata*) were discovered boring in the twigs of the coffee shade tree, *Inga inga*, during 1938–39. They are heavily parasitised, and are apparently controlled, by *Apanteles* sp., *Eurytoma* sp. and undescribed species of *Microbracon* and *Ageniaspis*. Parasites reared from *Acrocercops dives*, Wlsm., on *I. laurina* in 1938–39 were *Euderus lividus*, *Elachertus* sp. and undescribed species of *Ufens* and *Cirrospilus*.

DELEON (D.). **Some Observations on Forest Entomology in Puerto Rico.**—*Caribb. Forester* 2 no. 4 pp. 160–163, 2 refs. Río Piedras, P.R., 1941. (With a Summary in Spanish.)

The author outlines the results of a brief survey in 1940 in the forests of Porto Rico, the Virgin Islands and the Dominican Republic of insect activities affecting seed production and germination, seedlings in nurseries, forest management and forest products. Insects that destroy either the developing flowers or the seeds often make it difficult to obtain adequate supplies of seeds for nurseries or other uses, and root-feeding insects as well as Coccids and defoliators damage nursery stock. It seems unlikely that single species of insects will affect forest management as seriously in these regions as in those with a temperate climate, though *Hypsipyla grandella*, Zell., was doing relatively serious damage to *Cedrela mexicana* in Porto Rico, and appears to be causing increasing injury to mahogany [*Swietenia*], which sometimes occurs in the same plantations [cf. *R.A.E.*, A 29 427]. The larvae mine in the centres of new shoots, which wilt and die, causing stunting and excessive branching and sometimes killing small trees. It is considered that growing the trees under unnatural conditions has contributed to the increase in activity of this Pyralid [cf. 30 204].

Homoptera are abundant in the forests, and some of them may possibly be vectors of virus diseases. For example, injury to the leaves of *Cedrela* in Porto Rico by *Dikraneura cedrelae*, Oman [cf. 26 288] causes them to turn yellow and fall; the trees may thus lose their leaves several times in a year and so suffer a serious loss of increment. Termites, particularly *Eutermes* (*Nasutitermes*) *costalis*, Hlmgr., and *Kaloterms* (*Cryptoterms*) *brevis*, Wlk., do great damage to forest products, especially those imported from the United States.

CLEARE (L. D.). **Report on the Entomological Division for the Year 1940.**—3 pp. multigraph. [Georgetown] Dep. Agric. Brit. Guiana, 1941.

In 1940, sugar-cane in British Guiana was damaged locally by the weevil, *Rhynchophorus palmarum*, L., after attacks by *Castnia licoides*, Boisd.; a single outbreak of *Ligyris ebenus*, DeG., was reported. The Amazon fly [*Metagonistylum minense*, Tns.] maintained its control of *Diatraea saccharalis*, F., in spite of the long drought [cf. *R.A.E.*, A 30 221], and parasitised nearly 43 per cent. of the larvae in fields in which it occurred. Outbreaks of *Laphygma frugiperda*, S. & A., occurred on young rice after the rains began in May, and attack by *D. saccharalis*, just before reaping, caused a loss of about 10 per cent. of the crop. About 50 per cent. of the larvae of *D. saccharalis* on rice were parasitised by *M. minense*. Coconut palms were infested by *Brassolis sophorae*, L., and *Strategus aloeus*, L., and copra that had been in storage for some time by *Necrobia rufipes*, DeG.

HAYWARD (K. J.). **Las cochinillas de los cítricos tucumanos y su control.** [The Coccids of *Citrus* in Tucumán and their Control.]—*Bol. Estac. exp. agríc. Tucumán* no. 32, 29 pp., 17 figs., 8 refs. Tucumán, 1941.

The author discusses the life-history and economic importance of Coccids, and gives a key to those that attack *Citrus* in the Province of Tucumán, Argentina, together with notes on their appearance, food-plants, bionomics, and in

some cases natural enemies. They comprise *Lepidosaphes beckii*, Newm., which is the most important, *Chrysomphalus dictyospermi*, Morg., *C. ficus*, Ashm. (aonidium, auct.), *Parlatoria pergandei*, Comst., *Prontaspis* (*Unaspis*) *citri*, Comst., *Pinnaspis aspidistrae*, Sign., *Lecanium deltae*, Lizer, *Coccus* (L.) *hesperidum*, L., *Saissetia oleae*, Bern., *Lecaniodiaspis dendrobii*, Dgl., *Icerya purchasi*, Mask., *Ceroplastes* spp. and *Pseudococcus* spp. Methods of control are discussed in a final section; fumigation is considered impracticable under local conditions, and sprays are recommended. Spraying should not be carried out in the winter, which is very dry.

HINTON (H. E.). **Coleoptera associated with stored Nepal Barley in Peru.**—*Bull. ent. Res.* **32** pt. 3 pp. 175–183, 7 figs., 22 refs. London, 1941.

The author describes the adults of both sexes of *Eufalloides holmesi*, gen. et sp. n., and *Adistemia rileyi*, sp. n., and redescribes those of *Coninomus subfasciatus*, Rtttr. These Lathridiids, together with a few examples of *Cryptophagus cellaris*, Scop., and the Ptinid, *Trigonogenius globulus*, Sol., were taken in 1937 on the floor and walls of a room in which Nepal barley was stored at Lake Titicaca, Peru. *T. globulus* was probably feeding on the barley, and the others were almost certainly living on moulds or smuts. Previous records of *C. cellaris* in stored products, etc., in various parts of the world are summarised. Keys to the genera of the tribe LATHRIDIINI and the species of *Adistemia* are included.

HINTON (H. E.). **The Lathridiidae of economic importance.**—*Bull. ent. Res.* **32** pt. 3 pp. 191–247, 67 figs., 4 pp. refs. London, 1941.

This paper includes a key to the adults of 30 species of Lathridiids that have been recorded on stored food products or found in warehouses, granaries or mills and of a further 11 species that have been recorded in houses and cellars or appear likely to infest stored food, descriptions of the adults of all these species except three recently described [see preceding abstract], notes on their distribution, habits, synonymy and distinguishing characters, keys to and descriptions of all known mature larvae and pupae, and observations on the life-histories of six species.

MACGILL (E. I.). **On the Biology of *Dysdercus howardi*, Ballou. II. The Effect of continued Inbreeding on the Life History.**—*Bull. ent. Res.* **32** pt. 3 pp. 185–190, 4 refs. London, 1941.

The following is the author's summary: A number of generations of *Dysdercus howardi*, Ballou, bred in the laboratory between 1932 and 1934 [cf. *R.A.E.*, A **23** 498] are compared with a similar number of generations bred from 1940 to 1941. There is found to be no significant difference in the length of the life-cycle in the two periods. There is a significantly greater number of adult female insects in the earlier generations of *D. howardi* (eleven generations). In the later generations there is a higher percentage of infertile eggs. The difference between the two groups of insects is highly significant. There is no significant difference in the percentages of nymphs becoming adult in the two periods. The differences in the numbers of adult insects and in the sex ratios obtained in 1932–34 and 1940–41 are found to be non-significant (twelve generations).

The Common Furniture Beetle.—*Leaflet. For. Prod. Res. Lab.* no. 8 revd., 6 pp., 4 figs., 7 refs. Princes Risborough, 1941.

This revised leaflet [cf. *R.A.E.*, A **21** 204; **25** 464, etc.] comprises an account of the life-history of *Anobium punctatum*, DeG., in England, the damage

it causes to timber and furniture and methods of treatment to eradicate it. In some cases, fumigation is the only treatment possible. Hydrocyanic acid gas is the most effective fumigant, but the most dangerous; volatile liquids, such as carbon bisulphide, benzene and carbon tetrachloride, are sometimes used in a box with a tight-fitting lid for the fumigation of small articles.

[BELYAEV (I. M.).] **Беляев (И. М.). A chemical Control Measure against the Frit Fly.** [In Russian.]—*Bull. Plant Prot.* 1940 no. 4 pp. 43–52, 1 graph. Leningrad, 1940.

An account is given of experiments carried out in the Province of Moscow in 1936–39 with bait-sprays for the control of *Oscinella frit*, L., on cereals. The sprays contained various sugar by-products of the molasses type, usually at a concentration of 1 per cent., and as a result of preliminary laboratory tests, the poison selected was sodium fluosilicate, which was used at a concentration of 0.5 per cent. It was shown that a spray containing sodium fluosilicate was still able to cause considerable mortality of the flies even after it had dried on the plants.

The results obtained in field tests were very promising, and improvements were obtained by altering the type of sugar by-product. The one that proved to be the best contained 46–48 per cent. crystalline sugar and 15–20 per cent. invertase, and it was equally effective when the concentration in the spray was reduced from 1 to 0.5 per cent. When it was used, the numbers of flies in sprayed plots were reduced, in comparison with control plots, by about 95 per cent., and in 1939, when it was used at the higher concentration, it reduced the infestation of cereals by 70 per cent. and increased the yield by 5–20 per cent. Some improvement was obtained in 1938 by the addition to the spray of 0.01 per cent. oil of aniseed, mint or fennel, but in large-scale tests in 1939 aniseed oil did not increase the mortality. Promising results were given in the laboratory by baits of bran or sand, moistened with the spray, and some mortality of flies was obtained in the field by scattering the moistened sand at the rate of a handful per square yard. This method of application could be used if the plants are too small to be sprayed, or if it is desired to reduce the numbers of the fly in meadows without making the grass poisonous to cattle.

The technique of spraying is discussed. The spray should be applied at a rate equivalent to 4½ gals. per acre. Spring-sown cereals should be sprayed as soon as the flies appear in the field, which they usually do between 15th and 26th May, when early varieties of apples are beginning to flower, and again at the beginning of tillering, when the second stem has 1–2 leaves. If the flies are abundant (up to 50 per sweep) and the temperature is 18–26°C. [64.4–78.8°], a third application is necessary. The intervals between applications should usually be 8–10 days. During the three years of experiments, no bees were observed on the treated cereals, even when these were only 220 yards from an apiary.

[OSTROVSKIĖ (N. I.).] **Островский (Н. И.). A bio-chemical Method for the Determination of the Death of the Larvae of *Systole coriandri* Nik. after Fumigation of Seeds.** [In Russian.]—*Bull. Plant Prot.* 1940 no. 4 pp. 53–56, 5 refs. Leningrad, 1940.

The Eurytomid, *Systole coriandri*, Nikol'skaya, is a serious pest of coriander [*Coriandrum sativum*] in the Province of Voronezh, sometimes infesting up to 86 per cent. of the fruits and so greatly decreasing the yield of oils and reducing the germinating power of the seeds [cf. R.A.E., A 25 400]. The larvae diapause

in the fruits from August to May, and can be controlled in storage by fumigation, but the effectiveness of the treatment cannot immediately be estimated, since the dead larvae are externally indistinguishable from living ones. A search was therefore made for a chemical method of distinguishing them, and it was found that dinitrobenzene, which has been used for measuring the intensity of cellular respiration in living organisms, was promising. When this substance penetrates living cells, it combines with hydrogen in the process of cellular respiration to form compounds that turn red in the presence of ammonia. Since the chitinous integument of the larvae was impervious to a solution of dinitrobenzene, it was punctured with a needle and the larvae were placed in a saturated solution for 5–6 hours at 18–20°C. [64·4–68°F.] or for 3 hours at 30°C. [86°F.]. Penetration to the cells was satisfactory. The larvae were then transferred to filter paper and placed in a vessel containing strong ammonia, in the fumes of which larvae that had been alive at the beginning of the experiment turned red in 10–15 minutes. In about half an hour, all larvae turned brown. It was shown by this method that all the larvae from seeds fumigated with chloropicrin at the rate of 3 oz. per 100 cu. ft. for 48 or 24 hours or with the saturated vapours of ether or chloroform for 18 hours were killed by the fumigation. Only 94 per cent. mortality was given by fumigating the seeds with carbon bisulphide at the rate of 2 oz. per 10 cu. ft., since 6 per cent. of the larvae turned red. Mortality of larvae of *Sitodrepa* (*Stegobium*) *panicea*, L., was also determined by this method.

After fumigation with hydrocyanic acid gas, however, all larvae coloured when treated with dinitrobenzene and ammonia, dead larvae of *Systole* retaining this ability for 6 weeks after fumigation and those of *Sitodrepa* for 5–10 days. This was probably due to the fact that hydrocyanic acid gas does not kill the cells immediately it reaches them and the reaction with dinitrobenzene is thus not completely prevented. This indicates some variation in the changes that occur in the tissues of insects killed by different insecticides, and it is, therefore, impossible to establish a bio-chemical method of ascertaining mortality that would be uniform for all insecticides.

[ДОЙНИКОВ (A. V.). Дойников (A. B.). A new Control Measure against the Codling Moth. [*In Russian.*].—*Bull. Plant Prot.* 1940 no. 4 pp. 65–66. Leningrad, 1940.]

In view of the frequent failure of the usual measures to control *Cydia pomonella*, L., on apple in the Russian Union, investigations were carried out in Astrakhan in 1939 on the value against the adults of bait-sprays applied in the evening. Preliminary laboratory experiments showed that the length of life in days of the moths and the numbers of eggs deposited by females of the overwintered and first generations averaged 14·1, 62 and 161·4 for individuals given water and 7·2, 0·6 and 18·4 for those deprived of it. The consumption of water, which is present in the field in the form of dew, is therefore essential for normal fecundity. Sprays containing barium chloride and various arsenic and fluorine compounds gain complete mortality of the moths in 3–4 days in the laboratory, while nicotine sulphate killed them all on the first day, and corresponding reductions were obtained in the numbers of eggs laid. When heavily infested apple and quince trees were sprayed daily at dusk (the former from 15th June to 24th August and the latter from 20th July to 31st August) with a 0·5 per cent. solution of sodium fluosilicate at the rate of 1½ pint per tree applied from a hand-sprayer that dispersed the liquid in large drops, the percentages of uninjured fruit at harvest were 31·3 and 20, respectively, as compared with 63·6 and 58 in the controls.

The total numbers of applications required by late and early apples and quince are 100, 70 and 40, respectively, and it is considered that the cost would be amply covered by the increased yield.

[CHERNUISHEV (P. K.) Чернышев (П. К.). **The Manner of increasing the Efficiency of Fumigation against Store Pests.** [In Russian.]-*Bull. Plant Prot.* 1940 no. 4 pp. 67-69, 1 graph. Leningrad, 1940.

Chloropicrin is widely used in the Russian Union against insects and mites infesting stored products, but the eggs of the various pests, especially those of the mites, survive the fumigation. In preliminary laboratory experiments by the author and K. N. Bolotin in 1936, complete mortality of the active stages of *Tyroglyphus farinae*, DeG., was given by fumigation with chloropicrin at the rate of 4-5 oz. per 1,000 cu. ft. for 15-120 minutes at 20°C. [68°F.], but eggs that had just been deposited survived exposures of 9-10 days to dosages of 9-10 oz. per 100 cu. ft. and those 4-6 days old survived for 4-5 days when the dosage was 1 oz. per 100 cu. ft. Of the eggs of mites in small muslin cages placed in the upper, middle and lower layers of a heap of grain 30 ins. high, which was then fumigated with chloropicrin at the rate of 1 oz. per 10 cu. ft. of grain (the fumigant being released from a container on the top of the heap), 68-87 per cent. were still alive after 5 days exposure. The hypopi of *Glycyphagus* also proved very resistant.

A second fumigation is therefore necessary when the surviving eggs of the insects or mites are about to hatch, and a table based on the literature is given showing the durations at 15-20, 21-25 or 26-30°C. [59-68, 69-8-77 or 78-8-86°F.] of the egg stage of 24 species of insects that infest stored products. Figures for each insect at each temperature range are not available, but the egg stage at 21-25°C. is longest (12-17 days) in *Trogoderma granarium*, Everts, *Oryzaephilus surinamensis*, L., *Palorus (Caenocorse) depressus*, F., *Tenebroides mauritanicus*, L., and *Sitotroga cerealella*, Ol. The eggs of *Tyroglyphus farinae* hatch in about 6 days at 20°C., and those of other stored-product mites in 4-10 days. The adults appear 8-15 days later. It is therefore recommended that fumigation should be repeated after about a fortnight if infestation is not completely controlled by a first treatment.

[MEIER (N. F.) Мейер (Н. Ф.). **Species and Races of the Genus *Trichogramma* Westw.** [In Russian.]-*Bull. Plant Prot.* 1940 no. 4 pp. 70-77, 17 refs. Leningrad, 1940.

The author discusses the status of the egg parasites of the genus *Trichogramma* that have been observed in the Russian Union, most of which have been considered to be races of *T. evanescens*, Westw. [cf. R.A.E., A 27 589]. He concludes, however, that the Central Asiatic race and one bred from *Cydia pomonella*, L., at Slavyansk, are distinct species, for which he proposes the names *T. turkestanica* and *T. pallida*, respectively, and that the Azov-Black-Sea race represents the typical *T. evanescens*. A fourth new species is *T. pini*, which was bred from eggs of *Dendrolimus pini*, L. The adults of these species differ in body measurements and coloration after prolonged breeding in eggs of *Sitotroga cerealella*, Ol.; the measurements are shown in a table and a key to them is given.

A list is also given of six races of *T. evanescens* that occur in the Union. These are the Azov-Black-Sea race bred at Slavyansk from the eggs of *Mamestra brassicae*, L.; the Astrakhan race from eggs of *C. pomonella*; the dark brown Armavir race from eggs of Noctuids; the Romnui race from eggs of *Agrotis segetum*, Schiff.; the Azerbaijan race from eggs of *Heliothis armigera*, Hb.; and the Balashov race. The body measurements of the first five are given in a table. The Saratov race bred from eggs of *C. (Laspeyresia) microgramma*, Gn., and the Slavyansk cabbage-white race, bred from eggs of *Pieris brassicae*, L., are considered to be identical with the Astrakhan and the dark brown Armavir races, respectively. An account is given of laboratory observations on the effect of temperature and humidity on *T. turkestanica* and the Azerbaijan,

Azov-Black-Sea and Romnui races of *T. evanescens*, the main conclusions of which have already been noticed [27 590]. The numbers of offspring resulting after 1 month from batches of 100 females kept under optimum conditions were over 2 million for *T. turkestanica* and over $1\frac{1}{2}$ million, over $1\frac{1}{4}$ million and less than 831,000 for the Azerbaijan, Azov-Black-Sea and Romnui races, respectively. Preliminary observations showed that the Astrakhan race is suitable for use in dry hot areas.

[ISMAILOV (Ya. I.) & SHCHICHENKOV (P. I.).] **Исмаилов (Я. И.) и Щиченков (П. И.). Observations on the Behaviour of the Egg-parasite *Trichogramma evanescens* Westw. in the Top of a Fruit Tree.** [In Russian.]—*Bull. Plant Prot.* 1940 no. 4 pp. 78–80, 2 figs. Leningrad, 1940.

In the course of field demonstration work in the Crimea in 1938 on the value of releasing *Trichogramma* against *Cydia pomonella*, L., on apple, it was observed that the distribution of parasitism on the tree was very uneven, and further investigations were therefore carried out in 1939 in which unparasitised eggs of *Sitotroga cerealella*, Ol., on cards were fixed to the leaves of four non-bearing apple trees. The cards were fixed at different heights on the north, south, east and west sides of each tree, and 1,000 examples of the Astrakhan, the Azov-Black-Sea, a local Crimean and the Mokrzhetzkiï race of *T. evanescens*, Westw., were released on the 4 trees, respectively. Fresh cards were substituted every 24 hours, and those that were removed were kept until the parasitised eggs could be distinguished by their dark colour. Temperature and relative humidity were normal (an average of 23.5°C. [74.3°F.] and 65 per cent.).

The results showed that the Crimean race, and especially the Astrakhan one, tended to congregate in the upper region of the crown, whereas the Azov-Black-Sea race preferred the middle region, and the Mokrzhetzkiï race was evenly distributed, with a slight preponderance in the upper zone. The lower zone was visited very little by any race.

It appears, therefore, that most of the parasites move upwards from the point of release, and that the existing method of releasing them in the middle part of the crown almost excludes the lower region from their field of activity. Better results would be obtained if the parasites were liberated in the middle of the lower zone of the crown. On the whole, parasitism was not affected by weather or by position with regard to the cardinal points. The Crimean and Astrakhan races were still very active 16 days after release.

[ALEKSEEV (Ya. A.).] **Алексеев (Я. А.). The biological Control of the noxious Corn Bug *Eurygaster integriceps* Put. by means of Egg-parasites.** [In Russian.]—*Bull. Plant Prot.* 1940 no. 4 pp. 81–88, 4 figs., 12 refs. Leningrad, 1940.

In view of the severe damage caused to cereals by *Eurygaster integriceps*, Put., in the various parts of southern European Russia [cf. R.A.E., A 27 554; 29 574], investigations on its bionomics were carried out in the Province of Rostov in 1938 and in the Province of Stalin (southern Ukraine) in 1939. The distribution in cultivated fields of bugs that had hibernated in an adjoining forest showed that most of them had flown in directions contrary to the prevailing winds. Their activity in the fields depended on temperature; they were inactive below 17°C. [62.6°F.], climbed up the plants at 19°C. [66.2°F.] and flew about at 21.5°C. [70.7°F.]. In 1938, the first eggs were observed on 16th May on the leaves of winter wheat, and oviposition continued until 21st June, the eggs being laid on the top part of the leaves and on the stems and ears of cultivated and wild graminaceous plants, and also on *Euphorbia*. In 1939 oviposition lasted from 8th May until the beginning of July, and some

eggs were laid on dry stems of maize and sunflowers left in the fields after harvest, and on the clods of soil under which the bugs sheltered. The number of eggs in a batch varied from 4 to 28, but was usually 14. Single females laid up to 122 eggs. In 1938, the first nymphs were observed on 29th May and the first adults on 24th June. When the plants had been seriously damaged or the crop was harvested, the bugs migrated to adjoining fields. To protect such fields from infestation, a strip 11 yards wide should be left along the edge of the harvested field and the bugs that concentrate in it should be collected regularly. Migration to hibernation quarters started in 1938 on 6th July, when the harvest was beginning, and the mass flight took place on 15-17th July, but some bugs had not left the fields in late September. Many bugs that alighted on bare ground died, probably because the soil was too hot. Many more bugs hibernated in forests of oak and maple, which have a comparatively thick layer of fallen leaves, than in pine forests. They first concentrated at the edge under the growth at the base of the tree trunks, but by the end of October most of them had migrated to the shadier parts of the forest. Up to 1 per cent. of the hibernating bugs were killed by the white muscardine fungus, *Beauveria bassiana*.

Egg parasites [cf. 30 240] were too scarce at the beginning of the oviposition period of the bugs to exercise any appreciable control, but they became more active towards the end of it. *Microphanurus vassilievi*, Mayr, and *M. semistriatus*, Nees, represented 71.9 and 22.1 per cent. of those found in the Province of Rostov, the others being *Telenomus sokolowi*, Mayr, and *Dissolcus rufiventris*, Mayr. The species observed in the Province of Stalin, other than *Schedius telenomicida*, Vasil'ev, have already been noticed [29 582]. *S. telenomicida* was reared from eggs of the Coreid, *Syromastes (Mesocerus) marginatus*, L., in the Province of Rostov and, both as a primary and secondary parasite, from a few eggs of *Eurygaster integriceps* in the Province of Stalin; it has previously been recorded as a hyperparasite, but was reared in the laboratory as a primary parasite on eggs of *S. marginatus*, *Dolycoris baccarum*, L., and *Carpocoris pudicus fuscispinus*, Boh.

The bionomics of *Microphanurus vassilievi* were observed under conditions approaching those in nature. Its life-cycle was completed in 9 days at a mean temperature of 32.7°C. [90.86°F.] and 60 per cent. relative humidity, and in 13 days at 24.6°C. [76.28°F.] and 64 per cent. Besides *E. integriceps*, it readily attacked the eggs of *D. baccarum* and *C. p. fuscispinus*. The technique by which *E. integriceps* was bred in winter for the propagation of parasites is briefly described [cf. 29 582].

[SHCHPETIL'NIKOVA (V. A.). Щепетильникова (В. А.). The Biology of *Microphanurus semistriatus* Nees., the Egg-parasite of the Corn-bug (*Eurygaster integriceps* Put.). [In Russian.]-Bull. Plant Prot. 1940 no. 4 pp. 89-92, 1 graph, 4 refs. Leningrad, 1940.]

The bionomics of *Microphanurus semistriatus*, Nees, which parasitises the eggs of *Eurygaster integriceps*, Put., on cereals, were studied in 1939 in the Province of Stalin (southern Ukraine). For this purpose, batches of recently laid eggs of *E. integriceps* parasitised by the Scelionid were pasted on leaves of winter wheat in the field, and when the adults emerged, fresh eggs were supplied for them to oviposit in. During the oviposition period of the bug, which lasted from 8th May until early July, *M. semistriatus* produced three complete generations. There were sharp fluctuations in the temperature and relative humidity of the air. The duration of development of the parasite decreased as the average and minimum temperatures rose, and lasted 21-29, 13-19 and 11-17 days at mean temperatures of 20.2, 24.7 and 23.6°C. [68.36, 76.46 and 74.48°F.], with minima of 6.5, 10 and 8°C. [43.7, 50 and 46.4°F.], and average relative

humidities of 69.5, 70.3 and 60.1 per cent., respectively. Females constituted 77–85 per cent. of all the parasites that emerged. The fertility of the females was determined for two generations by confining 40 fertilised females of each generation singly in test-tubes covered with muslin and placed among the wheat at half the height of the plants. Fresh egg-batches of the bug were daily offered to them for oviposition, and the eggs were then transferred to separate test-tubes. The mean temperature and humidity were 18.4°C. [65.12°F.] and 75 per cent. for the first generation, and 25°C. [77°F.] and 72 per cent. for the second. All the females oviposited, and the numbers of eggs per female averaged 88.8 and 108.6 for the two generations, respectively; the females survived for up to 12 and 19 days.

If the parasite is to be used for control, a first liberation should be made when the bugs begin to oviposit, and a second, 10–15 days later, during the peak of oviposition. Eggs laid subsequently will be destroyed by parasites emerging from the earlier ones.

[MACH (G. É.).] **Мач (Г. Э.). The Species Composition of the Hosts of the most important European Species of Scoliids.** [In Russian.]—*Bull. Plant Prot.* 1940 no. 4 pp. 93–101, 2 figs., 19 refs. Leningrad, 1940.

The author refers to recent laboratory work in Russia on the possible use against Lamellicorn larvae of native Scoliid parasites [cf. *R.A.E.*, A 29 572; 30 142], describes some of the breeding technique involved, and gives a list showing which of some 20 Lamellicorns were parasitised by the six more important Scoliids and the instars attacked. The host relations of each species are briefly discussed. Laboratory hosts not already noticed comprised *Melolontha hippocastani*, F., and *Anoxia pilosa*, F., for *Scolia dejeani*, Linden; *Cetonia aurata*, L., *Liocola lugubris*, Hbst., *Potosia aeruginosa*, Dru. (*speciosissima*, Scop.), and *Oxythyrea funesta*, Poda, for *S. hirta*, Schr.; *Anisoplia austriaca*, Hbst., *Anomala errans*, F., *A. dubia aenea*, DeG., and *O. funesta* for *S. quadripunctata*, F.; *M. hippocastani* for *Campsomeris klugi*, Linden, and *C. sexmaculata*, F.; and *A. errans*, *A. d. aenea*, *Anisoplia segetum*, Hbst., *A. deserticola*, Fisch., *Hoplia parvula*, Kryn., *Homaloplia ruricola*, F., *Serica brunnea*, L., *Maladera holosericea*, Scop., and *Anoxia pilosa* for *Tiphia femorata*, F.

Scolia haemorrhoidalis, F., proved of no economic value, since it parasitises only larvae of *Oryctes nasicornis*, L., which is not a pest.

KRISHNA AYYAR (P. N.). **The Biology and Distribution of the Parasites of the Cotton Stem Weevil, *Pempheres affinis* Fst. in South India.**—*Proc. Indian Acad. Sci.* 14 no. 5 Sec. B pp. 437–453, 5 pls., 22 refs. Bangalore, 1941.

A list is given of 15 Hymenoptera that parasitise the larvae of *Pempherulus* (*Pempheres*) *affinis*, Faust, on cotton and other plants in South India, together with descriptions of all stages and information on the life-history, frequency, distribution, alternate hosts and natural enemies of most of them. In addition to those already noticed [cf. *R.A.E.*, A 29 521, 522], they comprise *Eupelmus* sp. and *Microbracon* sp., which were bred from larvae on cotton, and *Eurytoma* sp. and *Aximopsis* sp., both of which are rare, from larvae on *Hibiscus esculentus*. *Eupelmella pectorator*, Ferrière, was bred in small numbers as a primary parasite of the larvae on cotton near Coimbatore, though it is also occasionally a hyper-parasite [cf. 29 522].

It is concluded that the percentage of natural parasitism in cotton fields is too low to afford adequate control, but that it might be improved by artificial multiplication and liberation of at least *Spathius critolaus*, Nixon.

GUPTA (B. D.). On *Epipyrops* (sp. n.): a Parasite on the Nymphs and Adults of the Sugarcane Leaf-hopper (*Pyrilla* sp.).—*Curr. Sci.* 9 no. 3 pp. 132–134. Bangalore, 1940. [Recd. 1942.]

All stages are described of *Epipyrops melanoleuca*, Fletcher. The larvae of this moth are parasitic on nymphs and adults of *Pyrilla* sp. on sugar-cane in the United Provinces. The eggs, several hundred per female, are laid on the surface of a leaf and hatch in 4–5 days. The larvae quickly attach themselves to their hosts, and their mouth-parts function as sucking organs. A single host may be attacked by several parasites. Death occurs if a host is not found within 2 days. The larvae leave the hosts after about a fortnight and pupate in cocoons. Some of the hosts die soon after the parasites have left them, while females that survive are incapable of oviposition. The adult moths emerge 7–10 days after pupating, the life-cycle lasting about a month. Males and females are about equal in number and live for about a week in captivity. Hibernation occurs in the pupal stage, and the first moths emerge at the beginning of April when the adults of *Pyrilla* are common. The first-generation moths appear a month later, but no sign of parasitism has been observed after this until the hot weather is terminated by the rains in July. The parasite is abundant from August to October, and hibernation begins in November. During the outbreak of *Pyrilla* in 1937–38, about 40 per cent. of the nymphs and adults were parasitised.

KAPUR (A. P.). A Note on the Lady-bird Beetles (Coccinellidae) preying upon the Cane White-fly, *Aleurolobus barodensis* Mask.—*Curr. Sci.* 9 no. 3 p. 134. Bangalore, 1940. [Recd. 1942.]

Aleurolobus barodensis, Mask., is a serious pest of sugar-cane in Orissa, owing to the damp temperate climate, the practice of ratooning and the application of ammonium sulphate, which causes the canes to grow quickly and thus escape the floods, but induces a succulent leafy growth that attracts insects. Little is known of the natural enemies of the Aleurodid, but the author observed the adults and larvae of the Coccinellids, *Coelophora octosignata*, Muls., *C. perrotteti*, Muls., *Chilomenes sexmaculata*, F., and *Verania discolor*, F., and the adults of *Coelophora* sp., *C. unicolor romani*, Muls., *Chilocorus nigrinus*, F., *Scymnus nubilus*, Muls., and *S. gracilis*, Motsch., preying on various stages in July and August 1939.

KRISHNAMURTI (B.). *Trichogramma minutum* Riley, in Relation to *Sitotroga cerealella* Ol. in Mysore.—*Curr. Sci.* 9 no. 12 p. 544. Bangalore, 1940. [Recd. 1942.]

When attempts were first made in Mysore about 1930 to use the eggs of *Sitotroga cerealella*, Ol., for breeding *Trichogramma minutum*, Riley, which was found to parasitise the eggs of the principal sugar-cane moth-borers, the females refused to oviposit in them, and so the eggs of *Corcyra cephalonica*, Staint., were used instead. In recent experiments, however, the females did not refuse the eggs of *S. cerealella*, and some 24 generations of the parasite have been bred in them.

THULJARAM RAO (J.) & VENKATRAMAN (T. S.). Hard Leaf Mid-rib in Sugar-canes and Resistance to Top-borer (*Scirpophaga nivella* F.).—*Curr. Sci.* 10 no. 3 pp. 171–172, 1 fig. Bangalore, 1941.

Anatomical studies of sugar-cane carried out at Coimbatore confirmed the existence of a correlation between the thickness of the mid-rib tissues of the

leaves and resistance to attack by *Scirpophaga nivella*, F. [cf. *R.A.E.*, A 28 3]. A definite inheritance of anatomical characters in hybrids of sugar-cane was evident, and it would appear possible by a suitable selection to introduce certain of the desired anatomical characters into new canes.

JONES (S.). **The Cardamom Weevil, *Prodiectes haemeticus* Chev. var. in South India.**—*Curr. Sci.* 10 no. 3 p. 172, 1 ref. Bangalore, 1941.

A variety of the weevil, *Prodiectes haemeticus*, Chev., which was reported from Ceylon in 1939 [*R.A.E.*, A 28 441], has recently caused similar damage to cardamom plants in Travancore. The entry of rots is facilitated by the tunnelling of the larvae in the rhizomes and pseudostems.

THULJARAM RAO (J.). **Rind Hardness as a possible Factor in Resistance of Sugarcane Varieties to the Stem Borer.**—*Curr. Sci.* 10 no. 8 pp. 365–366, 1 fig., 7 refs. Bangalore, 1941.

Investigations at Coimbatore showed that there was a fair positive correlation between the rind-hardness of sugar-cane and its resistance to *Diatraea venosata*, Wlk.; the rind-hardness and percentage infestation of nine varieties are given in a table. Since the anatomical characters that contribute to rind-hardness appear to be inherited, it should be possible to breed resistant canes.

CHERIAN (M. C.) & RAMACHANDRAN (S.). **Kernels of *Thevetia neriifolia* Juss.—a potent Insecticide.**—*Curr. Sci.* 10 no. 9 p. 412. Bangalore, 1941.

Investigations at Coimbatore showed that an effective contact spray can be obtained from the seeds of *Thevetia neriifolia* by soaking the mashed kernels in water for 24 hours, filtering the liquid and adding a small quantity of soft soap to it. Very satisfactory results were obtained against Lepidopterous larvae of several species and also against Aphids, Tingids and Psyllids. The optimum concentration appeared to be $\frac{1}{4}$ – $\frac{1}{2}$ oz. kernel in 1 gal. water (0.16–0.31 per cent.). Concentrations of 1–2 oz. per gal. were necessary against such Coccids as *Ferrisia* (*Pseudococcus*) *virgata*, Ckll., and *Saissetia nigra*, Nietn.

PRUTHI (H. S.). **A fresh Cycle of the Desert Locust in India.**—*Curr. Sci.* 10 no. 11 pp. 479–483, 3 figs. Bangalore, 1941.

Most of the general information in this paper and the account of the initial stages of the present outbreak of *Schistocerca gregaria*, Forsk., in India have already been noticed [cf. *R.A.E.*, A 29 519–520]. In the spring of 1941, heavy breeding in Baluchistan was successfully controlled, but in June–August north-western India was invaded by two successive waves of immigrant swarms that came from the west and reached as far as Hissar, to the east, and the Punjab, to the north. Oviposition took place mostly in south-eastern Baluchistan, in Sind and in western Rajputana, and the resultant swarms, which began to appear in September, spread to cultivated areas in North Sind, Khairpur, Bhawalpur and the western Punjab, and eastwards and south-eastwards to the United Provinces and central India.

BARTLETT (K. A.). **The Introduction and Colonization in Puerto Rico of beneficial Insects parasitic on West Indian Fruitflies.**—*J. Agric. Univ. P. Rico* 25 no. 1 pp. 25–31, 1 ref. Río Piedras, P.R., 1941.

An account is given of the introduction into Porto Rico since 1935 of parasites considered likely to be of value against *Anastrepha mombinpraeoptans*,

Señ, and *A. suspensa*, Lw. These Trypetids commonly infest mangos, guavas and jobos (*Spondias* spp.), and *A. suspensa* also occurs in *Citrus* fruits. It is found chiefly in fleshy fruits, whereas the jobo, a preferred host-fruit of *A. mombinpraeoptans*, is thin-fleshed, so that the larvae are more accessible to attack by parasites. Parasites imported in 1935–37 comprised *Pachycrepoides dubius*, Ashm., *Diachasma* (*Opius*) *cereum*, Gah., another species close to it, *Eucoila* (*Hexamerocera*) sp., *Ganaspis* sp. and an unidentified Diapriid, which parasitise *Anastrepha* spp., from Brazil; *Dirhinus giffardi*, Silv., *Opius fletcheri*, Silv., *Diachasma* (*O.*) *fullawayi*, Silv., *O. humilis*, Silv., *Biosteres* (*O.*) *tryoni*, Cam., and *Tetrastichus giffardianus*, Silv., which parasitise *Ceratitis capitata*, Wied., from Hawaii; *Ashmeadopria* sp., *Eucoila* sp., *Pachycrepoides dubius*, *D. cereum*, *O. bellus*, Gah., and *E. (Pseudeucoila) brasiliensis*, Ashm., which parasitise *Anastrepha* spp., from the Panama Canal Zone; *O. perproximus*, Silv., from West Africa; and *D. (O.) crawfordi*, Vier., which parasitises *A. ludens*, Lw., from Mexico. In all, 133 shipments were received, and 13,158 parasites arrived alive.

With the exception of *D. giffardi* and *P. dubius*, which parasitise the pupae, the introduced species were parasitic on the larvae, but the adults of all of them emerge from the puparium of the host. *D. giffardi* was reared in the laboratory in large numbers on both species of *Anastrepha*, *Musca domestica*, L., and *Toxotrypana curvicauda*, Gerst.; *P. dubius* was reared on both species of *Anastrepha*, *M. domestica*, *Lyperosia* (*Haematobia*) *irritans*, L., and *Sarcophagula occidua*, F.; *O. bellus* was reared on *A. mombinpraeoptans* infesting jobo; *D. crawfordi* was not reared from either species of *Anastrepha* in jobo or guava, though the adults inserted their ovipositors into the fruits; *O. humilis* was reared from *A. suspensa* on pomarosa [*Eugenia jambos*] but did not oviposit in *A. mombinpraeoptans* in mango; and *B. tryoni* was reared from *A. mombinpraeoptans* in jobo and mango. Liberations of all the parasites except *Ganaspis* sp. were made in 1935–38, and the numbers released and the localities are shown in a table.

Frequent collections of infested fruits have since been made, but with the exception of *B. tryoni*, obtained from *A. mombinpraeoptans* on *Spondias* in 1935 and 1936, there have been no recoveries from them. Collections of *P. dubius* were made near the points of release, but it is possible that it may already have been present in Porto Rico.

Five species of native parasites were reared in 1935–38 from *A. mombinpraeoptans* and six from *A. suspensa*, but only *Opius anastrephae*, Vier., which was bred from both species, is of importance [cf. *R.A.E.*, A 27 502; 28 492]; the others occur only occasionally, and the percentage parasitism by them is less than 1. A list of their genera is given, but they are not specifically identified. Shipments of *O. anastrephae* were made to Hawaii in 1935 for trial against *C. capitata*, and consignments of *D. giffardii* were sent to the Dominican Republic in 1938 and 1939.

JOHNSON (F.). **The complex Nature of White-clover Mosaic.**—*Phytopathology* 32 no. 2 pp. 103–116, 2 figs., 26 refs. Lancaster, Pa., 1942.

A detailed account is given of investigations in which it was shown that white-clover mosaic, a disease that causes streak when transmitted to the garden pea, is caused by two distinct viruses, which the author names *Marmor efficiens* or pea-mottle virus and *M. repens* or pea-wilt virus. The symptoms they caused in various plants and their properties are described, and plants to which they were transmitted are shown in a table. *M. repens* infected only Leguminosae, but *M. efficiens* was also transmitted to plants in 4 other families. Neither virus was transmitted by *Macrosiphum onobrychidis*, Boy. (*pisi*, Kalt.) from infected peas, clovers and *Medicago lupulina* to healthy plants.

HEUBERGER (J. W.) & TURNER (N.). **A Laboratory Apparatus for studying Settling Rate and Fractionation of Dusts.**—*Phytopathology* **32** no. 2 pp. 166–171, 2 figs., 6 refs. Lancaster, Pa., 1942.

The following is the authors' summary. An apparatus is described for use in studying the settling rate and fractionation of dusts. The features of this apparatus are a settling tower of simple design, an exposure chamber for making serial exposures of slides or leaves to the dust cloud in the settling tower, a dust magazine (charge tube) from which almost instantaneous and complete discharge can be obtained by an air blast, and a simple mechanism for introducing known charges of dust into the settling tower. Consistent results have been obtained with this apparatus.

SOKOLOFF (V. P.) & KLOTZ (L. J.). **Mortality of the Red Scale on Citrus through Infection with a Spore-forming Bacterium.**—*Phytopathology* **32** no. 3 pp. 187–198, 3 figs., 7 refs. Lancaster, Pa., 1942.

Details are given of laboratory experiments in which a bacterium, tentatively designated *Bacillus* "C," which was isolated from soil in California, was shown to be capable of destroying *Aonidiella aurantii*, Mask., on *Citrus* fruits, especially lemons [cf. *R.A.E.*, A **30** 57]. Infection was obtained by immersing the infested fruit in suspensions of the bacillus in water or in peptone-water cultures of it. Satisfactory wetting of the fruit presented considerable difficulty, and an immersion of 2–4 hours was necessary to obtain a good mass infection. Crawlers were attacked with greater rapidity than adults. The symptoms of infection are described and discussed.

ST. GEORGE (R. A.). **Protection of Log Cabins, Rustic Work, and unseasoned Wood from injurious Insects.**—*Fmrs' Bull. U. S. Dep. Agric.* no. 1582 (revd.), 22 pp., 25 figs., 14 refs. Washington, D.C., 1941.

The bulk of this revised bulletin is a reprint of the previous edition [*R.A.E.*, A **18** 42]. Additional information includes preventive treatments by impregnating trees with suitable preservatives against powder-post beetles (of which *Xylobiops basillare*, Say, is the only species of importance in the eastern United States) and Longicorns that cannot be controlled by seasonal cutting and seasoning, and further treatments for wood that has become infested. The most convenient method of impregnation is to fasten the top of the tree to be treated to one close at hand and then cut its trunk at such a height that it can be conveniently lowered into a vessel containing the solution, in which it should stand for about 10 days. A table is given showing the concentrations and quantities of solutions of copper sulphate or zinc chloride recommended for impregnating trees varying in girth from 3 to 12 inches at breast height. Beetles infesting wood can be destroyed by spraying or brushing the surface with orthodichlorobenzene either undiluted or mixed with fuel oil (1 : 8). The mixture is recommended for logs, and its toxicity is increased by the addition of 6 oz. naphthalene flakes per U.S. gal. A formula for treating beetle-infested wood in old buildings, comprising 50 per cent. orthodichlorobenzene, 47 per cent. kerosene and 3 per cent. barium oleate, was developed in England [cf. **14** 48], and a mixture of turpentine and kerosene (1 : 9) is recommended there, and is stated not to mar the finish on wood.

NELSON (R. H.) & CASSIL (C. C.). **Adsorption of Mercuric Chloride from Solution by *Gladiolus* Corms.**—*Circ. U.S. Dep. Agric.* no. 610, 10 pp., 12 refs. Washington, D.C., 1941.

The immersion of corms of *Gladiolus* in solutions of mercuric chloride is recommended as a control measure against *Taeniothrips simplex*, Morison,
(1017) [A]

in Canada and the United States [cf. *R.A.E.*, A **23** 757; **24** 249, etc.], and, in numerous tests by the senior author, all stages of the thrips were destroyed when unpeeled corms were immersed in a 0.1 per cent. solution (1 oz. in $7\frac{1}{2}$ U.S. gals. water) for 12–17 hours, the longer period being recommended. The extent to which the mercuric chloride is adsorbed by the corms was therefore investigated, with a view to determining the possibility of using the same solution for several batches of corms. The corms were immersed for periods of from 2 to 17 hours in just enough solution to cover them and the burlap bag containing them. About half the initial weight of mercuric chloride was removed by the corms and the bag, after immersion for 7 hours or more, and this amount was not affected by the length of the immersion period or by the size of the corms, but was influenced by the temperature at which the treatment was carried out. In contrast to the amount of mercuric chloride removed, the volume of the solution was reduced only about 10 per cent. by 17 hours' soaking. Attempts to discover a rule-of-thumb method for restoring used solutions to their initial concentration were unsuccessful.

WILSON (J. W.). **The Gladiolus Thrips in Florida.**—*Bull. Fla agric. Exp. Sta.* no. 357 pp. 3–22, 24, 6 figs., 28 refs. Gainesville, Fla., 1941.

WATSON (J. R.). **Other Thrips found on Gladiolus.**—*T. c.* pp. 22–24.

It is stated in the first paper that *Taeniothrips simplex*, Morison, all stages of which are described, has been found since 1932 in all parts of Florida in which *Gladiolus* is grown commercially. The larvae and adults damage the plant and flower spike and cause indirect as well as direct injury to the corms by reducing the vigour of the plants. Breeding on a number of other plants has been reported, but *Gladiolus* is the principal food-plant, though a few varieties have been found resistant to attack. Most of the eggs are deposited under the outer cell layer between the veins of the leaves, and the larvae are usually at the base of the leaves or under the bracts round the individual flower buds. All stages can usually be found on growing plants during all seasons of the year. Details are given of the results of studies of the effect of temperature on their duration and on oviposition. Complete development lasted 13–36 days, and 20 generations were reared in a year. Only males developed from unfertilised eggs.

Gladiolus is not grown commercially in Florida in summer, when conditions are unfavourable, and the thrips survive on self-sown plants. Large numbers are destroyed by the frequent heavy rains that usually occur between June and September. In autumn, they migrate to the new plantings and begin to multiply, and feeding and reproduction continue more slowly during December and January. Temperatures low enough to destroy *Gladiolus* plants occasionally occur in many parts of the State, but the adult thrips survive short periods of frost and infest the new plants that grow after the cold periods. In December 1934, when the average temperature was 57.5°F. and frosts occurred on two successive nights, adults ceased to oviposit and eggs failed to hatch. Between February and May, when the weather is warm and dry and most favourable for rapid development, the population increases rapidly, and serious commercial damage results.

T. simplex appears to have no natural enemies of economic importance, but two Coccinellids were observed feeding on adults and larvae in Florida. Complete mortality of all stages of the thrips occurred on corms that were stored at temperatures of 38–40°F. during the inactive period. Fumigating the corms with calcium cyanide at a dosage of 3 oz. crude calcium cyanide (44 per cent. active calcium cyanide) per 1,000 cu. ft. space for 3 hours gave a complete mortality of all stages but the egg, and had, therefore, to be repeated once or twice at intervals of 10 days for effective control. A single fumigation with a mixture of three parts ethylene dichloride and one part carbon tetrachloride at the rate of 14 lb. (5 U.S. quarts) per 1,000 cu. ft. space for 18 hours killed all

stages. Neither treatment damaged the corms. Submerging the corms for 18 hours in a solution of 1 oz. mercuric chloride per 7½ U.S. gals. water gave complete mortality of all stages of the thrips; corms treated with this solution sprouted more slowly than untreated ones, but were otherwise unaffected. In field experiments carried out in 1938-40 with a variety of sprays, one containing 4 lb. commercial tartar emetic, 16 lb. brown sugar and 100 U.S. gals. water gave the best control of the thrips on growing plants. The spray should be applied 5-7 times at weekly intervals from the time when the first signs of injury are observed at the base of the plant, unless infestation is very heavy, when more frequent applications may be necessary, and should be allowed to collect in droplets.

In the second paper, the author states that in addition to *Taeniothrips simplex*, five species of thrips occur on *Gladiolus* in Florida. The commonest is *Frankliniella cephalica*, Crwf., which confines its attacks chiefly to the blooms; it is not a serious pest of *Gladiolus* cut for sale, but may do severe damage to flowers left to open in the garden. The others, which are of little or no commercial importance, comprise *F. fusca*, Hinds, *F. insularis*, Franklin, *Haplothrips gowdeyi*, Franklin, and *Thrips tabaci*, Lind. A key to the six species is appended.

MACKIE (D. B.) & others. **Bureau of Entomology and Plant Quarantine.**—*Bull. Dep. Agric. Calif.* **29** (1940) no. 4 pp. 225-267. Sacramento, Calif., 1941.

In 1940, further attempts were made in California to eradicate citrus white fly [*Dialeurodes citri*, Ril. & How.], obscure scale [*Chrysomphalus obscurus*, Comst.] and *Lepidosaphes (Nilotaspis) halli*, Green [cf. *R.A.E.*, A **29** 221]. The latter Coccid was taken on almond on an estate adjoining the United States Plant Introduction Gardens, in which all previous infestations have been recorded; its occurrence in a new focus of infestation reopens the problem of this scale, and the whole property was sprayed in May with summer oil as a precautionary measure. Observations indicate that the females are viviparous, reproduction occurring between early May and November, and that the scale is highly susceptible to hydrocyanic acid gas. Failure to eradicate *C. obscurus* on pecan in San Diego County appears to be due to the mechanical difficulties of spraying the trees, which reach 70 ft. in height. Red scale [*Aonidiella aurantii*, Mask.] was recorded on walnut, *Citrus* and other plants in Ventura County, and fumigation with hydrocyanic acid gas was carried out. Walnut was not injured by dosages up to 24 cc. per 100 cu. ft. [cf. **29** 564].

The introduced Ichneumonid, *Bathyplectes curculionis*, Thoms. [cf. **29** 401, 409] has held the alfalfa weevil [*Hypera variabilis*, Hbst.] in perfect control on lucerne in the San Francisco Bay region, even where conditions favoured the weevil. In continued surveys for cherry fruit-flies of the genus *Rhagoletis* [cf. **29** 222], *R. fausta*, O.-S., was taken in Nevada and Plumas Counties [cf. **29** 565]. Observations indicate that the Californian race of this fly, like that of *R. cingulata*, Lw., is confined to *Prunus emarginata*, but fruit-flies from California are being tested in Oregon to determine their ability to infest cultivated cherries and also to observe whether they will interbreed with the Oregon races. Larvae of the potato tuber moth [*Gnorimoschema operculella*, Zell.] were found infesting tomato fruit in Los Angeles, Santa Barbara and Monterey Counties during October. Observations on the distribution of the tomato pinworm [*Keiferia lycopersicella*, Busck] indicate that it requires a high mean summer temperature before assuming economic importance; it is more abundant in the southern counties but is largely replaced on tomatoes in the central coastal region by *G. operculella*.

Fumigation of commodities with methyl bromide was continued on an extensive scale [cf. **29** 222]. Tests showed that when balled *Citrus* nursery stock

was fumigated at a dosage of 2 lb. per 1,000 cu. ft. for 2 hours to destroy certain Coccids, an occasional survival occurred if the temperature was below 78°F. Vacuum fumigation of walnut meats for 90 minutes with 3 lb. methyl bromide per 1,000 cu. ft. proved very successful, and fumigation of stocks of almonds under atmospheric pressure at a dosage of 1 lb. per 1,000 cu. ft. for 24 hours gave equally good results. Highly efficient control of storage insects, including the Indian meal moth [*Plodia interpunctella*, Hb.], was achieved, while the bromide residues in parts per million were 0.0051 or less on the walnuts and only 0.0012 on the almonds [cf. 29 444]. In tests to determine dosage schedules for fumigation with hydrocyanic acid gas against the olive scale [*Parlatoria oleae*, Colv.] on nursery stock at winter temperatures, dosages equivalent to 1 oz. and 2 oz. sodium cyanide per 100 cu. ft. for 1 hour and 45 minutes, respectively, gave complete mortality.

Outbreaks of grasshoppers were less severe in 1940, and the heaviest infestations developed in the southern part of the State. The principal species were the same as in 1939 [cf. 29 222], but *Melanoplus packardi*, Scud., occurred in considerable numbers with others in grain fields in two counties. The crop losses were heaviest on cultivated areas bordering range lands. In Kern County, 25 miles of trenches 30 inches wide and 24 inches deep were dug with ditching machines, with the excavated soil on the side nearest the grasshoppers, which were trapped in the trench and killed by burning. Dusts of 5 per cent. sodium dinitro-cresylate applied at the rate of 20 lb. per acre were lethal to grasshoppers, adults being killed almost immediately.

Brief notes are given on a large number of other insects and mites observed. The mites include the blister mite [*Eriophyes pyri*, Pgst.], which caused considerable damage to pear buds in northern California; *Phyllocoptes eurynotus*, Nal., which injured celery in San Joaquin County; and *P. destructor*, Keifer [cf. 29 565], which caused russetting of the fruit and defoliation on greenhouse and field tomatoes in the lower San Joaquin and Sacramento Valleys. The earliest damage by *P. destructor* occurred on soils that were deficient in plant food and highly alkaline; the population increased as the season advanced, and by September infestations and losses were fairly widespread. All varieties common to this area were attacked, and the mite also occurred on *Solanum villosum* and morning glory [*Ipomoea*], though it probably does not breed on the latter. The citrus thrips [*Scirtothrips citri*, Moul.], was easily controlled by sprays of tartar emetic, sugar and water. *Blapstinus fuliginosus*, Csy., attacked tomatoes and asparagus and was controlled by poison bran mash. *Lepidosaphes ficus*, Sign., which was formerly known only from plants of the genus *Ficus*, was observed on elm in 1939 and on walnut and rose in 1940, and *Cryptorhynchus lapathi*, L., a serious pest of willows and poplars, was taken on birch, this being the first record that the weevil is established in California. The Tortricid, *Proteoteras aesculanum*, Ril., damaged apple and box-elder [*Acer negundo*] near Sacramento and in the San Francisco Bay region.

Notes on revisions of quarantine regulations against a number of insect pests, and lists of injurious insects intercepted at maritime and air ports, at border inspection stations and within the State are appended.

SMITH (Edwin), RYALL (A. L.) & CASSIL (C. C.). **The Removal of Lead and Arsenic Spray Residues.**—*West. co-op. Spray Proj. Rep.* 1940, 6 pp. multigraph. [Seattle, Wash., 1941.]

The tolerances for lead and arsenic (As_2O_3) on fruit in the United States were raised in 1940 from 0.025 and 0.01 to 0.05 and 0.025 grain per lb., respectively, and in view of this the tests described in this paper were carried out at Yakima, Washington, to determine to what extent the severity of the washing processes used to clean apples sprayed with lead arsenate could be reduced. The results are shown in tables. It was found that only fruits sprayed with relatively

light spray schedules could be adequately cleaned by a single cold wash of hydrochloric acid (1 per cent.) ; the average lead and arsenic residues on these fruits before washing were 0.119 and 0.046 grain per lb. The use of somewhat heavier spray schedules left about 3 times as much residue and required the application of some heat in either single washes of hydrochloric acid or sodium silicate (80 lb. per 100 U.S. gals.) or dual washes of sodium silicate or mineral oil (1 per cent.) followed by hydrochloric acid. Heavily sprayed fruit could be cleaned to meet the new tolerances only by the application of relatively severe dual washes at temperatures that approach or exceed those likely to injure the fruit.

UDINE (E. J.). **The Black Grain Stem Sawfly and the European Wheat Stem Sawfly in the United States.**—*Circ. U.S. Dep. Agric.* no. 607, 9 pp., 7 figs., 6 refs. Washington, D.C., 1941.

Trachelus (Cephus) tabidus, F., which until 1919 was present on wheat in the United States only in scattered localities in five north-eastern States, has spread to the south and west, and has now reached central Ohio and the border between Virginia and North Carolina. In 1934–37 it caused more serious injury to wheat in western Pennsylvania and eastern Ohio than elsewhere ; it is not yet abundant in Virginia, but is becoming more important each year in the north-eastern part of it. In eastern Pennsylvania, however, it is being gradually replaced by *Cephus pygmaeus*, L., which was restricted to New York State until 1919, when it was found invading Pennsylvania. *C. pygmaeus* usually causes less serious losses than *T. tabidus*, although infestations of up to 65 per cent. in wheat fields have been recorded, but in areas in which both species are present, the adults of *C. pygmaeus* emerge about a week earlier than those of *T. tabidus*. Since several sawfly eggs may be laid in a single stem, but only one larva reaches maturity, it is assumed that the larvae of *C. pygmaeus* destroy eggs and ensuing larvae regardless of species. The distribution of the two sawflies and the spread of *T. tabidus* are shown on maps.

Wheat and rye are attacked by both species, and their life-histories are similar. The females oviposit in the upper internodes of the wheat stems when the wheat is beginning to head. The larva hatches in 4–7 days and feeds on the inner lining of the stem, gradually working downwards, until it has become full grown and has reached the base of the plant at harvest time. It then forms a plug in the stem and immediately below this makes an incision round the stem, leaving just enough outside fibre intact to hold the stem erect, while beneath a second plug, formed directly below this, it forms a silk-lined cylindrical cell in which it overwinters. As the stem dries and becomes more brittle, the weight of the head, together with the action of wind or rain, breaks it off. The remaining stub, containing the inactive larva, is left in the ground until the following spring when pupation and emergence take place. There is only one generation a year.

C. pygmaeus and *C. tabidus* can be distinguished by the type of cut they make on the wheat stem. The former leaves more of the epidermis uncut, so that there is an irregular, ragged edge at the point where the stem is broken, whereas the latter cuts more completely, and the stem when finally separated presents a finely serrated edge. A key based on the suranal processes is given to the larvae of the two species and *C. cinctus*, Nort., which also attacks wheat in the United States but does not occur in the areas infested by the others.

The chief parasite of *T. tabidus* is *Pleurotropis benefica*, Gah., and that of *C. pygmaeus* is *Heterospilus cephi*, Rohw. [*cf. R.A.E.*, A 20 80]. Attempts to establish the Ichneumonid, *Collyria calcitrator*, Grav., against both species are now being made [*cf. 27 381*]. Control measures comprise deep ploughing of the stubble, while to avoid much loss from falling straw in heavily infested areas the wheat should be cut just before it is completely ripe, when the crop can be

harvested before much lodging occurs. Cultural practices and fertilisers that encourage a strong, heavy stand help materially to reduce losses due to these sawflies.

COTTON (R. T.) & WAGNER (G. B.). **Control of Insect Pests of Grain in Elevator Storage.**—*Fmrs' Bull. U. S. Dep. Agric.* no. 1880, 22 pp., 12 figs., 3 refs. Washington, D.C., 1941:

This bulletin, which supersedes portions of an earlier one [*cf.* *R.A.E.*, A 25 722] comprises a discussion of some of the factors influencing insect infestation of grain in elevators in the United States, together with recommendations for its prevention or the control of the insects involved. *Calandra* (*Sitophilus*) *oryzae*, L., *C. (S.) granaria*, L., and *Rhizopertha dominica*, F., are the most serious pests in terminal elevators; they are able to bore into sound grain, and are followed by others that cannot penetrate the tough outer skin. Infestation by *Plodia interpunctella*, Hb., and other moths sometimes occurs on the surface of stored grain, but does not usually extend far below the surface, as the moths are unable to make their way into the binned grain. *Sitotroga cerealella*, Ol., is a serious pest of wheat before it is threshed in some parts of the United States, but does negligible damage in elevators; *Tribolium confusum*, Duv., *T. castaneum*, Hbst., and other beetles that are secondary pests in elevators, are important in flour mills. The main sources of infestation in terminal elevators, which include the growing crops, grain stores on farms, country elevators and the railway vans in which the grain is transported, and the methods of control are discussed.

Although the cleaning machinery used in modern elevators removes many insects and damaged kernels, it does not eliminate all free-living insects or the immature stages within the grain, and other methods, such as the application of cold, heat or fumigants, must be employed. Since insect pests of stored grain are inactive at temperatures below 50°F., injury to the grain will be prevented if it can be maintained at such temperatures. During cold weather, grain can be cooled by transferring it from one bin to another; even if the general temperature of the grain is not much lowered, this process will break up colonies of insects that cause local heating [30 218]. The susceptibility to insect attack of grain with a high moisture content can be greatly reduced by drying; and the high temperatures used also kill the insects that infest it. Exposure to a temperature of 140°F. for 10 minutes, exclusive of the time taken by the grain to warm up, kills all grain-infesting insects.

If these methods of control are impracticable, infested grain should be fumigated. General instructions on fumigation are given, with detailed descriptions of the methods used. Fumigants applied in the grain stream include chloropicrin [*cf.* 25 722] and granular crude calcium cyanide (25 per cent. available hydrocyanic acid gas). The latter is used at dosages of 10–25 lb. per 1,000 bushels with double the dosage for the first and last 500 bushels. It does not damage wheat, yellow maize, barley or oats, but causes spotting of white maize or polished rice. The grain should be left undisturbed for at least two and three days, respectively, after fumigation with chloropicrin and calcium cyanide. Germination is unaffected by chloropicrin when the grain has a moisture content of 12 per cent. or less, but is affected in proportion to the moisture content when this is higher [*cf.* 29 429]; calcium cyanide has no effect on the germination or the milling or baking qualities of wheat when used at 10–20 lb. per 1,000 bushels. A mixture of ethylene dichloride and carbon tetrachloride (3 : 1), and mixtures of carbon bisulphide and carbon tetrachloride (1 : 4) with or without the addition of small quantities of sulphur dioxide or other chemicals, are used at rates of 3 and 1½ U.S. gals. per 1,000 bushels respectively. They should be applied to the first hundred and last few hundred of each 1,000 or 1,500 bushels in the grain stream, any excess being sprinkled on the grain, which

should be left undisturbed for at least three days after treatment; they do not affect the germination of the grain. A mixture of liquid ethylene oxide and solid carbon dioxide (1 : 10 by weight) is very effective [cf. 25 723, etc.]. When this fumigant is used in an open bin, the surface of the grain, which should be about 10–12 feet below the top of the bin, should in addition be covered with a layer of the mixture. There is no danger of imparting residual odours to the grain with standard brands of any of the fumigants recommended. It has been found that dusts are of little value in protecting grain that is susceptible to insect attack, unless they are poisonous and therefore unsuitable for use in grain intended for food.

In country elevators, where small amounts of grain are received daily, it is often desirable to treat partly filled bins after each new load is added. Heavy gases, such as chloropicrin or the mixtures of ethylene dichloride or carbon bisulphide and carbon tetrachloride should be applied evenly over the surface of the grain at the recommended dosage. Full bins can be treated with any of the fumigants at double the dosage recommended for terminal elevators if they have closed tops, or with any but calcium cyanide if they are open [cf. 27 341; 29 429]. When the elevators are empty, they can be fumigated with calcium cyanide at 3 lb. per 1,000 cu. ft. for 24–36 hours to destroy insects in the structure and in accumulations of waste grain. After such treatment, the fumigation of incoming grain will be unnecessary for some time. Grain stored in bags in warehouses that can be made airtight can be fumigated with methyl bromide [cf. 29 429]. In loosely constructed warehouses, individual stacks of bagged grain can be fumigated under a gas-tight tent or blanket, the edges of which should be weighted to prevent leakage of gas; air space should be provided at the top of the stack to permit diffusion of the gas. Sodium cyanide (to produce hydrocyanic acid gas), chloropicrin, methyl bromide or a mixture of ethylene dichloride and carbon tetrachloride should be used at dosages of $3\frac{1}{2}$, 2, 1 and 17 lb. per 1,000 cu. ft.

PINCKNEY (J. S.) & STITT (R. E.). **Tests of Species and Varieties of Vetch for Resistance to the Vetch Bruchid.**—*Circ. U. S. Dep. Agric.* no. 617, 5 pp. Washington, D.C., 1941.

The following is substantially the authors' summary. Observations in North Carolina during 1936, 1937 and 1938 on plantings of different species and varieties of vetch, both in open field conditions and under cages, with exposure to high populations of the vetch Bruchid (*Bruchus brachialis*, Fhs.) in all cases, showed that heavy infestations resulted in *Vicia villosa*, *V. dasycarpa*, *V. atropurpurea* and *V. caroliniana*. A few eggs were deposited on *V. sativa*, *V. pannonica* and *V. melanops*, but no Bruchid adults matured in the seed in the course of the investigations. Twelve other species of *Vicia* and *Lathyrus hirsutus* were tested in the same experiments, but no eggs were deposited on them.

SMITH (C. F.). **A new Species of Hymenopterous Parasite of the Pea Aphid** (*Macrosiphum pisi* Kaltenbach).—*Ann. ent. Soc. Amer.* 34 no. 3 pp. 537–538, 1 ref. Columbus, Ohio, 1941.

The species of *Aphidius* parasitising the pea Aphid, *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.), in Utah and recorded as *A. rosae*, Hal. [cf. *R.A.E.*, A 27 31] is here described from adults of both sexes as *A. pisivorus*, sp. n. Characters are given distinguishing it from *A. rosae* and the European species, *A. medicaginis*, Marsh. It was observed in moderate numbers in most of the pea fields visited in Utah during the summer of 1937.

CARTER (Walter). *Peregrinus maidis* (Ashm.) and the Transmission of Corn Mosaic I. Incubation Period and Longevity of the Virus in the Insect.—*Ann. ent. Soc. Amer.* **34** no. 3 pp. 551–556, 4 refs. Columbus, Ohio, 1941.

In the investigations described, the incubation period of the virus of maize mosaic [*Marmor zeae* of Holmes] in about 170 examples of the vector, *Peregrinus maidis*, Ashm., varied from 11 to 29 days, with four exceptions; the exceptional cases, in which the incubation period varied from 4 to 10 days, occurred within related insects, suggesting that the ability of *P. maidis* to transmit the virus after an abnormally short incubation period is controlled by genetic factors. Feeding the Delphacids on an artificial culture solution during the incubation period did not appear to result in any lengthening of the period. In the majority of cases, the virus was transmitted without interruption to a series of plants until shortly before the death of the insect, when two-day feeding periods were allowed, but in some cases, one or more plants in the course of a series of positive transmissions were not infected, and some individuals lived for a considerable period after the last positive transmission, indicating that the virus content of the insects was exhausted. The latent period of development of the disease in maize varied from four days in vigorously growing young plants to 24 days when the growth of the plant was retarded.

GAHAN (A. B.). A Revision of the Chalcid-flies of the Genus *Monodontomerus* in the United States National Museum.—*Proc. U. S. nat. Mus.* **90** no. 3116 pp. 461–482, 6 refs. Washington, D.C., 1941.

Two of the new species described, both from the United States, are *Monodontomerus indiscretus*, bred from *Phyllotoia nemorata*, Fall., in birch leaves, and *M. subobsolitus*, bred from *Malacosoma americana*, F., and *Cydia* (*Grapholitha*) *molesta*, Busck, and from *Spilocryptus extrematis*, Cress., in the cocoons of *Samia cecropia*, L.

GORHAM (R. P.). Aphid Flights observed in New Brunswick.—*Canad. Ent.* **73** no. 9 pp. 157–158. Guelph, Ont., 1941.

In the course of 6 years' survey of Aphids in potato fields in New Brunswick [cf. *R.A.E.*, A **29** 302], it was shown that in some districts heavy infestations of *Myzus persicae*, Sulz., producing large numbers of alates, develop in the first week of August, whereas in others this Aphid does not become abundant until later in the month. On 19th August 1939 and 15th August 1940, mass flights of Aphids passing up the River St. John were observed at Perth by A. E. McCollom and W. S. Hoar. The flights occurred during the early evening and continued until after dark, when the Aphids were attracted to lighted windows. Aphids collected in 1939 comprised equal numbers of *M. persicae* and *M*[*acrosiphum*] *solanifolii*, Ashm., but in 1940, when the flight was smaller, a third unidentified species was also present. On this occasion, the wind was very light, and the Aphids moved at an estimated speed of 4 miles per hour. In both years, Aphids were scarce in the potato-growing areas north of Perth before the flight, but serious infestations developed a few days after it.

JACOBSON (L. A.) & FARSTAD (C. W.). Some Observations on differential Feeding on maturing Wheat Varieties by Grasshoppers.—*Canad. Ent.* **73** no. 9 pp. 158–159. Guelph, Ont., 1941.

Although grasshoppers in Canada are not generally believed to injure cereals severely after they have passed the seedling stage, they also cause considerable damage during the period between the first appearance of the heads and ripening, when they defoliate the plants, cut off the heads or feed on the glumes or kernels. In August 1940, two experimental plots, each containing 41 varieties

of wheat, were seriously attacked by *Melanoplus mexicanus*, Sauss., at two places in southern Alberta. The percentage of heads cut in each plot, together with the mean percentage, is given for each variety in a table. There was a definite varietal difference in susceptibility, the mean percentage of heads cut varying from 0.3 to 42.8. Replicated varieties exhibited only slight differences within each plot, but differences between varieties in contiguous rows were sharp and distinct, and the degree of infestation did not appear to be influenced by the position of any one variety with regard to another. Despite the difference in the severity of infestation in the two plots, the same varieties were most heavily damaged in both; in only one variety were the glumes and kernels attacked to any appreciable extent. The authors point out that the results of this experiment, which was designed for another purpose, should not be regarded as conclusive, since in larger plots the freedom of selection would be considerably restricted.

WALLEY (G. S.). **Some new and little known Canadian Ichneumonidae (Hymenoptera).**—*Canad. Ent.* **73** no. 9 pp. 164–170, 2 refs. Guelph, Ont., 1941.

The new species of Ichneumonids described include *Casinaria semiothisae*, which was bred from larvae of *Semiothisa granitata*, Gn. [cf. *R.A.E.*, A **29** 36] in Ontario, Quebec, Nova Scotia, New Brunswick and British Columbia, *S. sexmaculata*, Pack., in Saskatchewan, and *S. bisignata*, Wlk., in Ontario.

BROWN (A. W. A.). **Annual Report of the Forest Insect Survey 1940.**—27 pp., 10 maps, 1 ref. Ottawa, Dep. Agric. Canada, 1941.

An account is given of the work of the Forest Insect Survey in Canada [cf. *R.A.E.*, A **28** 514, etc.] during 1940. The area covered by the survey and its scope have continued to increase, and 10,081 samples were received during the year, including some from the Queen Charlotte Islands. Brief notes are given on the incidence of some 140 species of insects that attack forest trees in Canada, of which the more important were *Gilpinia polytoma*, Htg., on spruce [cf. **29** 531, **30** 285], *Harmologa (Cacoecia) fumiferana*, Clem., on spruce and balsam fir [*Abies balsamea*], the biological race of this Tortricid that attacks jack pine [*Pinus banksiana*], and *Agilus anxius*, Gory, on birch. The distribution of light, medium and heavy infestations of these species and also of *Cryptococcus fagi*, Bär., on beech, *Chermes (Adelges) piceae*, Ratz., on balsam fir, *Malacosoma disstria*, Hb., on poplar and *Pristiphora erichsoni*, Htg., on larch are shown on maps, and the degree of infestation by each of 20 species in each of 25 districts, with the outstanding species in each district, is shown on a chart.

A very heavy infestation of *H. fumiferana* developed in 1940, with the result that practically all the balsam fir over 7,000 sq. miles in northern Ontario is dead or dying; in north-western Ontario, this Tortricid is becoming conspicuous on balsam fir and spruce, and in southern Manitoba it has severely defoliated larch as well as attacking spruce; infestation increased on balsam fir in British Columbia.

BEALL (G.). **Method of estimating the Population of an agricultural Pest over Areas of many Square Miles.**—*Canad. J. Res.* (D) **19** no. 9 pp. 267–277, 3 refs. Ottawa, 1941.

The following is based on the author's introduction and abstract. Entomologists are frequently concerned with the population of an insect in fields under a particular crop over a region many square miles in extent, when the position and number of the fields involved are initially unknown. It was desired to find how accurately the total number of insects and the average number per unit area can be estimated under such conditions by sampling. The insect considered as an example was *Leptinotarsa decemlineata*, Say (larvae and adults),

as it occurred on 13th July 1937 in the potato fields of an area of 59 square miles in part of a township in Ontario. A sample was obtained by examining a randomly chosen fraction (0.001) of each field in a random selection of the blocks into which the township is divided by roads. Although the estimate proved better when the amount of sampling in a field varied with the size of the field, it is shown that the more convenient practice of sampling equally in all fields, regardless of their size, would be followed by little deterioration of the estimate.

MUÑOZ PINOCHET (H.) & TESSI SEITÚN (S.). **Resultados de la experimentación de tratamientos contra las plagas animales del algodón.** [Results of experimental Work against Pests of Cotton.]—*Bol. mens. Junta nac. Algodón* no. 75 pp. 580–587. Buenos Aires, 1941.

This is a review of the results obtained in experiments in 1939–40 in the Chaco Territory of Argentina on the use of sprays and dusts against pests of cotton. Highly satisfactory control of the larvae of *Alabama argillacea*, Hb., without any injury to the plants, was given by "Larval" (an official insecticide containing 40 per cent. arsenic trioxide and 22 per cent. sodium hydroxide) applied at a concentration of 0.15 per cent. with the addition of 5 per cent. prickly-pear mucilage, and at the rate of 22 gals per acre. The mucilage is prepared by macerating 30 lb. finely chopped pads of *Opuntia tuna* in 10 gals. water for 24 hours and straining. The spray should be made up on the day of application, and the amounts stated should not be exceeded or scorching may occur. The mucilage can be replaced by other adhesives, such as 5 per cent. molasses. Good results were also given by sprays of Paris green, calcium arsenate and lead arsenate, but no minimum dosages were worked out. Of the dusts tested against *A. argillacea*, Paris green at the rate of 1 kg. per hectare [about 0.9 lb. per acre] in an inert carrier and undiluted calcium arsenate at 5 kg. were both effective in 36 hours, but this period is too long under local conditions, since rains are frequent. It was reduced to 10 and 7 hours by increasing the amount of Paris green per hectare to 1.125 and 1.5 kg., respectively, and to 10 hours by applying a mixture of calcium arsenate and Paris green (9:1) at 4.5 kg. Lead arsenate was less economical. None of the dusts caused any injury to the plants. Arsenical sprays and dusts were effective but slow in action against the larvae of the Noctuid, *Thyreion gelotopoeon*, Dyar, and the mixture of calcium arsenate and Paris green proved effective against the weevil, *Chalcodermus niger*, Hust., when applied at the rate of 5 kg. per hectare.

Good control of *Aphis gossypii*, Glov., was given by a dust of nicotine sulphate containing $7\frac{1}{2}$ per cent. nicotine and applied at the rate of 6.5 kg. per hectare, and it was cheaper than a spray of nicotine sulphate and soap. Sprays of nicotine sulphate and fish-oil soap were effective against the Tingid, *Gargaphia torresi*, Costa Lima, but too costly except on a small scale. Dust insecticides were, in general, preferable to sprays for the control of sucking insects. Finely powdered ordinary and hydraulic slaked lime is an excellent carrier for arsenicals in dusts, which should be applied when the leaves are wet with dew.

VIVAS-BERTHIER (G.). **Los "manchadores" del algodón en Venezuela.** [Cotton Stainers in Venezuela.]—*Bol. Soc. venezol. Cienc. nat.* 7 no. 48 pp. 115–119, 7 refs. Caracas, 1941.

In view of proposals to increase the cultivation of cotton in Venezuela, notes are given on the types of injury caused to it by *Dysdercus* and measures for the control of these bugs. The species of this genus that have been observed there are *Dysdercus ruficollis*, L., *D. pallidus*, Blöte, *D. chiriquinus*, Dist.,

D. fernaldi, Ballou, *D. peruvianus*, Guér., *D. obliquus*, H.-S., and *D. mimus*, Say. The last four have been taken in cotton, and the last two have not previously been recorded from Venezuela.

BALLOU (C. H.). **Notas sobre la introducción de un predator para el control de la escama algodonosa del naranjo.** [Notes on the Introduction of a Predator for the Control of *Icerya purchasi*, Mask.].—*Bol. Soc. venezol. Cienc. nat.* **7** no. 48 pp. 121–122, 2 figs. Caracas, 1941.

In February 1941, 60 adults of the Coccinellid, *Rodolia cardinalis*, Muls., were imported into Venezuela from the United States for use against *Icerya purchasi*, Mask., on orange. They oviposited in cages, and some of the larvae that hatched were placed on infested orange trees. The first adult emerged on 4th April 1941.

LEVER (R. J. A. W.). **Entomological Notes.**—*Agric. J. Fiji* **12** no. 3 pp. 77–80, 12 refs. Suva, 1941.

A fruit-fly that is very rare in Fiji has been identified, from a single adult taken by the author, as *Dacus* (*Strumeta*) *distinctus*, Mall., to which it was formerly considered to be closely related [cf. *R.A.E.*, A **24** 767]; the species also occurs in Samoa and Tonga. In November 1940, tea plants at Nasinu were found to be infested by larvae of the Tortricid, *Adoxophyes fasciculana*, Wlk., recorded previously from leaves of guava [28 136] and subsequently from those of rose and privet (*Ligustrum*). Stunted growth of the young shoots of egg-plant (*Solanum melongena*) and consequent dieback, reported in September 1940, were found to be caused by *Lygus muii*, Popp., which was effectively controlled by a spray of kerosene and soap; a subsequent outbreak was controlled by spraying with white oil (1 : 40). This Capsid also attacks dahlia petals and cowpea in Fiji, but damages them less severely, and examples of what is assumed to be the same species were collected on *Lantana* in Tonga. The author reports that the ambrosia beetle from coconut trunks referred to as *Xyleborus perforans*, Woll. [cf. 23 270; 29 169] has now been identified as *X. testaceus*, Wlk., which was recorded from twigs of *Hydnocarpus* and trunks of *Citrus* [cf. 29 169] and has more recently been found in logs of *Endospermum* sp. used in the construction of banana cases. To control this borer, timber should be stacked for as long as possible before use and well ventilated, as the seasoning of the wood kills the developing larvae. The Platypid, *Crossotarsus saundersi*, Chapuis [cf. 29 170] has been found in newly barked logs of *Cynometra grandiflora* and branches of a hardwood, probably *Sideroxylon* sp., and the Bostrychid, *Xylothrips religiosus*, Boisd. [cf. *loc. cit.*] in posts of *Cynometra*.

ZECK (E. H.). **Notes on the Aphididae in Australia. I. Two Aphids new to New South Wales.** (Hemiptera : Aphididae).—*Proc. Linn. Soc. N.S.W.* **66** pt. 3–4 pp. 219–222, 17 figs., 14 refs. Sydney, 1941.

The author gives brief descriptions of the alate and apterous viviparous females of *Myzus ornatus*, Laing, and *Rhopalosiphum rufomaculatum*, Wils. (*lahorensis*, Das), collected in New South Wales, and reviews the literature on their occurrence in other parts of the world. The former did not occur in colonies, isolated adults with a few progeny being found on the leaves of *Coleus* sp. grown indoors. The latter was observed in colonies mainly on the lower surfaces of the leaves and to a less extent on the flower heads of *Chrysanthemum* sp. grown out of doors; alate forms were relatively rare in the colonies, and examples of *Macrosiphum sanborni*, Gill., *Myzus persicae*, Sulz., and *Aphis gossypii*, Glov., were found among them.

EVANS (J. W.). **Tasmanian Grass-grubs.**—*Bull. Dep. Agric. Tasm.* (N.S.) no. 22, 23 pp., 7 figs., 12 refs. [Hobart] 1941.

An account is given of an investigation begun in Tasmania in 1938 on *Oncopera intricata*, Wlk., *O. rufobrunnea*, Tindale, and *O. intricoides*, Tindale, with particular reference to the environmental factors that enable them to become pests. The distribution of the injurious species of *Oncopera*, which also include *O. mitocera*, Turn., in Queensland, and *O. fasciculata*, Wlk., in South Australia and Victoria, is briefly discussed, and it is stated that records of *O. intricata* on the Australian mainland [cf. *R.A.E.*, A 9 566; 17 533; 20 325] are due to misidentification. Both the other Tasmanian species occur in Victoria and *O. rufobrunnea* also in New South Wales. The larvae of these Hepialids are subterranean and feed at night on surface vegetation; they are most important as pasture pests, but have been recorded as attacking lucerne, wheat, onion, carrot, strawberry and potato. In Tasmania, *O. intricata* is the most widespread and abundant species; *O. rufobrunnea* frequently injures pastures in the north-west, has been recorded as a pasture pest in the north midlands and has attacked strawberry plants in southern Tasmania; and *O. intricoides* has been seen flying in swarms over pasture, but is not known to occur as a pest.

The known stages of the Tasmanian species and *O. fasciculata* are described, and details are given of the life-history of *O. intricata* [cf. *R.A.E.*, A 17 534] with which those of the other species are compared. The adults of *O. intricata*, *O. rufobrunnea* and *O. intricoides* were found to occur from the last week in January to mid-March, from November to early January and from December to January, respectively, and the minimum durations of the egg stage of these species and *O. fasciculata* in the laboratory were 57, 18, 19 and 28 days, respectively, at temperatures of 18, 17.5, 20.5 and 14.7°C. [64.4, 63.5, 68.9 and 58.46°F.]. The prepupal stage of *O. rufobrunnea* lasts about 8 days, and the pupal stage of *O. intricata* 8–9 weeks; the pupal stages of the other species are thought to be considerably shorter. The eggs are deposited in sheltered positions on the ground. Analysis of the results of a comprehensive series of experiments carried out with *O. intricata* in 1940–41 showed that a large proportion of a batch of eggs hatches only when the atmospheric moisture in their immediate environment is adequate during the whole incubation period; that a small proportion may hatch if moisture is adequate for all except the early part of the incubation period; and that none will hatch if the eggs are dry at the end of the period. Since adequate moisture is necessary both to enable the eggs to hatch and to induce a growth of grass to serve as food for the newly-hatched larvae, widespread infestation by *O. rufobrunnea* and *O. intricoides* will occur only in abnormally wet seasons, when rainfall exceeds evaporation during December and January, respectively, or in areas that are regularly watered during the summer months. The same applies to eggs of *O. intricata* deposited in February, but conditions become increasingly favourable as the season advances, since even when rainfall does not become heavier, moisture becomes available on the soil as dew, and evaporation diminishes. The absence of *O. intricata* from the Australian mainland is probably due to the higher summer temperatures in Victoria, which would accelerate larval and pupal development and induce early flights of the moths, with the result that the eggs would be laid when conditions were unfavourable to their survival in most seasons. Infestation by *Oncopera* often becomes apparent during dry weather in September and October, because the growth of grass and clover is inhibited when the larvae are becoming increasingly voracious. Heavy infestation will not develop unless suitable cover, such as grass tussocks or a matting of dead grass, is present in the pasture when the eggs are being laid. The principal single factor that may prevent the development of infestations is very heavy rainfall, which swamps the tunnels and forces the larvae to the surface; this is most effective against *O. intricata* from August

onwards, when the larvae are in isolated vertical burrows [cf. 17 534]. It has also been recorded as destroying emerging adults in February and March.

These Hepialids can be controlled on lawns by the use of lead arsenate in a spray [cf. *loc. cit.*] or dust (25 per cent.). Poison baits were found to be of little use so long as grass was available. Control in pastures [cf. 19 273] involves steps to avoid the occurrence of dead or surplus grass and tussocks that shelter the eggs and larvae, and heavy stocking so that the grass is close-grazed and the larvae are killed by the trampling of the animals. Harrowing is of value if done before the larvae have made their burrows. The larvae are attacked by various natural enemies [17 533, 535], including two unidentified Tachinids reared from prepupae of *O. intricata* by the author, but they afford no appreciable control. Biological control, even if a suitable parasite could be obtained from another country, is considered to offer no promise in the case of an insect that fluctuates violently in abundance as a direct and immediate result of changes in weather and environmental factors.

PRUTHI (H. S.). **Report of the Imperial Entomologist.**—*Sci. Rep. agric. Res. Inst. New Delhi 1939-40* pp. 102-114. Delhi, 1941.

Laboratory experiments at New Delhi in 1939-40 showed that the optimum temperature for oviposition by *Earias fabia*, Stoll, on cotton was 25-30°C. [77-86°F.], the maximum numbers of eggs laid by a single female at 25 and 30°C. being 459 and 523, respectively. At 35°C. [95°F.], no eggs were laid at saturation deficiencies of 0 and 3 mm., whereas an average of nine was laid at one of 14 mm. Females that had been reared at 35°C. laid no eggs if they were kept at the same temperature, but an average of 156 and 112, respectively, if they were transferred to temperatures of 25 and 16°C. [60-8°F.]; whereas those reared at 25°C. and transferred to 35°C. laid an average of 116. Females of the parasite, *Microbracon lefroyi*, D. & G., laid no eggs if they were subjected to a temperature of 35°C. during the imaginal or pre-imaginal period, and this temperature is therefore more injurious to the parasite than to the host. The most favourable temperature for oviposition was 20°C., at which the average number of eggs laid was 55.4. The average longevity of adults of *E. fabia* and of fed or starved females of *M. lefroyi* was inversely proportional to the temperature, varying from 20 to 7, from 30.3 to 2.8 and from 20 to 1.79 days, respectively, between temperatures of 16 and 35°C. It was found that *M. lefroyi* could be reared on larvae of *Platyedra gossypiella*, Saund., in pods of *Hibiscus esculentus* in the laboratory in November-June, when *Earias* spp. are not available. Experiments carried out in view of the fact that *P. gossypiella* cannot be controlled in the United Provinces unless the larvae that hibernate within double seeds of cotton are destroyed, and that the amount of seed kept at the ginning factories is too great to be treated by exposure to the sun [cf. R.A.E., A 26 408; 27 576], showed that complete mortality of the larvae was obtained when the seeds were exposed to temperatures of 50, 55, 60, 65 or 70°C. [122, 131, 140, 149 or 158°F.] for over three hours, 40, 15, 7-10 and 2-3 minutes, respectively. When double seeds were exposed to the sun in a single layer, all larvae in them died within 10 minutes when the shade and soil temperatures were 42-47 and 60-66°C. [107.6-116.6 and 140-150.8°F.].

In continued investigations [cf. 29 183] tobacco leaf-curl [*Ruga tabaci* of Holmes] was transmitted by *Bemisia tabaci*, Gennadius (*gossypiperda*, Misra & Lamba) to tobacco from *Scoparia dulcis*. The local infestation of cucurbits by *Dacus ciliatus*, Lw., and *D. cucurbitae*, Coq., ranged from 40 to 80 per cent. between July and October; the Braconid, *Biosteres (Opus) compensans*, Silv., was parasitising 10-12 per cent. of the puparia in October and the beginning of November. Experimental varieties of safflower [*Carthamus tinctorius*] were heavily attacked by the Trypetid, *Acanthophilus helianthi*, Rossi, adults of which appeared in the field about the end of December [cf. 28 511]. After the first generation was completed

in the terminal shoots, the flower buds, which began to appear about the middle of January, were seriously infested. The percentage parasitism by *Eucoila* (*Tropideucoila*) sp. and *Ormyrus* sp. was only about 5 during March and April, but increased to 40 in the middle of May, when the crop was harvested. The Trypetid bred in wild safflower in uncultivated areas after the cultivated varieties were over, and systematic weeding in autumn should give effective control. Another serious pest of safflower was *Heliothis peltigera*, Schiff., which passes two generations on this plant from the middle of November to the middle of March.

Brief records are given of a number of other insect pests observed on crops, mainly in the Delhi area, but also in other parts of India and Afghanistan, including some noted for the first time or on new food-plants at Delhi. Parasites identified during the year included *Monodontomerus aereus*, Wlk., from *Euproctis signata*, Blanch., in Afghanistan, *Eretmocerus masii*, Silv., from nymphs of *Bemisia tabaci* at Pusa, *Encarsia isaaci*, Mani, from *Aleurolobus barodensis*, Mask., and *Neomaskellia bergi*, Sign., on sugar-cane at Delhi, *Goniozus indicus*, Mues., from *Emmalocera depressella*, Swinh., at Delhi, an undescribed variety of *Apanteles creatonoti*, Vier., from *Diatraea* sp. at Calcutta and *A. ruidus*, Wlkn., from *Sphenarches caffer*, Zell., and possibly *Hymenia recurvalis*, F. (*fascialis*, Stoll) at Delhi.

ISAAC (P. V.). **Report of the Second Entomologist (Dipterist) in Charge of Scheme for Research on Insect Pests of Sugarcane.**—*Sci. Rep. agric. Res. Inst. New Delhi 1939-40* pp. 115-119. Delhi, 1941.

In 1939, sugar-cane in New Delhi was attacked by the stem-borers, *Diatraea* (*Argyria*) *sticticraspis*, Hmps., *Raphimetopus ablutella*, Zell., and *Sesamia uniformis*, Dudgn., the root-borer, *Emmalocera depressella*, Swinh., and the top-borer, *Scirpophaga nivella*, F. Little injury was caused by *Pyrilla* spp. Larvae of *Scirpophaga nivella* were first observed in canes in the early part of July, and the resulting adults began to oviposit during August; larvae of the October generation hibernated until February, giving rise to adults that oviposited in the ratoon crop during March-April. The number of eggs per female was 51-118; the larval and pupal stages lasted 23-27 and 7-9 days during August-September, and adults lived 3-4 days. Females of *Sesamia uniformis* laid 78-84 eggs, and the larval and pupal periods were 34-44 and 8-9 days during June and July and 33-57 and 8-11 days in August and September [cf. R.A.E., A 29 184]. In Coimbatore, *Scirpophaga nivella* was fairly common throughout the year. *D. sticticraspis* was abundant on the shoots when the plants were about a month old, and infestation by *D. venosata*, Wlk., began when the plants were about three months old and continued until harvest. Notes are given on the incidence of *S. nivella* and *E. depressella* on five varieties of sugar-cane at Karnal and of the former on two varieties at Pusa. It was found that varieties that were resistant to *S. nivella* had more lignin towards the lower surface of the midrib than susceptible varieties [cf. 28 3; 30 302].

Mass liberations of *Trichogramma minutum*, Ril., against *Diatraea sticticraspis* were made near Sugauli in North Bihar, and there was evidence that the parasite reduced infestation by this species and by *E. depressella*. A threatened outbreak of the Hispid, *Asamangulia cuspidata*, Mlk., in August 1939 was controlled by parasites, and *Telenomus beneficiens*, Zehnt., gave considerable control of *S. nivella*. In April 1940, it was found that nearly 70 per cent. of the dead hearts at Sugauli were caused by *Anomala biharensis*, Arr., the adults of which feed on the underground portion of the stem.

KING (C. B. R.). **Report of the Entomologist for 1940.**—*Bull. Tea Res. Inst. Ceylon* no. 22 pp. 43-49. Talawakelle, 1941.

The main part of this report on insects attacking tea in Ceylon in 1940 deals with the shot-hole borer, *Xyleborus fornicatus fornicator*, Egg. Preliminary

results from an experiment to determine its incidence under conditions of heavy and light plucking indicated that, contrary to the general opinion, the proportion of affected branches was greater on light-plucked bushes, though these bushes bore smaller populations. It was shown that the greater part of the damage occurred towards the end of the pruning cycle and that practically all the breaking of branches that occurred below pruning level was due to borer damage alone or combined with wood-rot. *X. fornicatus*, Eichh., from castor (*Ricinus communis*) [cf. *R.A.E.*, A 29 381] bred in tea, rubber, *Albizzia falcata*, *Tephrosia candida* and *Mimosa bracaatinga*, and *X. f. fornicatior* in *M. bracaatinga*; lists are given of plants in which they bored galleries only. The number of outbreaks of nettle grubs [Limacodids] and the area attacked increased in 1940 [cf. 29 174], 21 estates being affected. Control measures comprised the collection of larvae and cocoons, spraying with soap solution when attacks were severe, and pruning when the attack was too widespread to be checked by any other measure. The number and extent of the outbreaks in various districts of Uva Province in 1931-40 and in each month of 1940 are shown in tables. Further possible vectors of phloem necrosis have been taken on tea [cf. 29 175]. Insects recorded from infected bushes included 11 Jassids, the Coccids, *Saissetia coffeae*, Wlk., *Pinnaspis theae*, Mask., and *Aspidiotus lataniae*, Sign., *Heliothrips haemorrhoidalis*, Bch., and an unnamed thrips; details are given of the life-cycles of three of the Jassids. An Agromyzid leafminer sometimes appears in large numbers on tea, laying its eggs under the epidermis of the upper surface of the leaves. The larvae make blister-like mines in the leaves. This insect has long been known as *Oscinis theae*, but is in fact a species of *Agromyza* (*Melanagromyza*).*

BETREM (J. G.). **Notes on the Genera *Goryphus* Holmgren 1868 and *Ancaria* Cam. 1902 (Hym. : Ichne. Crypt.). (Notes on Indo-Malayan Ichneumonids IV.)—*Treubia* 18 pt. 1 pp. 45-101, 10 figs. Buitenzorg, 1941.**

This study of certain groups of *Goryphus* and *Ancaria* includes descriptions of a number of species, of which 14 (7 in each genus) are new, keys enabling them to be distinguished from other species of CRYPTINI (including MESOSTENINI), and notes on the host relations of some species of *Goryphus*.

The parasites of the cacao fruit moth, *Acrocercops cramerella*, Sn., recorded from Java by Roepke as "C" [*R.A.E.*, A 1 56] were found to comprise males and females of *G. javanicus*, Roman, and one male of *G. fasciatipennis*, Szépl. Roepke later recorded *G. javanicus* under the name *Mesostenus* sp. [cf. 7 107], as a parasite of *Artona catoxantha*, Hmps. [3 311] and as a hyperparasite of *Setora nitens*, Wlk. [cf. also 27 347]. Species recently bred from *A. catoxantha* in Java comprise *G. fasciatipennis*, *G. javanicus*, *G. inferus*, Szépl., *G. bituberculatus*, Szépl., and *G. rufobasalis*, sp. n., which is the species recorded there by van Heurn from this host as *Mesostenus* sp. [10 128]. *G. (Cryptus) oxymorus*, Tosq., which has been recorded from *S. nitens* in Java [27 347], has also been reared there from *Parasa lepida*, Cram., on coconut. Gater's records of *G. maculipennis*, Cam., and *G. maculiceps*, Cam., as parasites of *Artona catoxantha* in Malaya [13 359] are considered doubtful, since his descriptions differ from the original ones.

Gambroides, gen. n., is erected for *Eripterimorpha javensis*, Rohw. (the type), *E. dammermani*, Rohw., and *Gambrus rufithorax*, Uch.

* The name *Oscinis theae*, Bigot [MS] was applied to it by Cotes (1894) and subsequently by Lefroy, who both figured, without describing, it. It seems to have been first described (from Java) by de Meijere [*Bijdr. Dierkunde* 22 p. 21. Leiden, 1922] under the name *Melanagromyza theae*, though he attributed it to Green. In view of divergent opinions as to whether the figures are adequate for recognition of the species, it would seem better to attribute it to de Meijere.—Ed.

DIAKONOFF (A.). **Descriptions and Records of Microlepidoptera from Sumatra and Java. (4th Communication on Indo-Malayan and Papuan Microlepidoptera).**—*Treubia* **18** pt. 1 pp. 191–199, 2 pls., 6 figs., 3 refs. Buitenzorg, 1941.

This paper includes descriptions of both sexes of the Pyralid, *Euzophera prionacra*, sp. n., bred from dry tobacco leaves in a fermentation shed, and of the genitalia of a male of the Gelechiid, *Dichomeris ostracodes*, Meyr., reared from rolled leaves of *Derris elliptica*, both in Sumatra.

CAPCO (S. R.). **Notes on the Orchid Bug, *Mertila malayensis* Distant, on White Mariposa (*Phalaenopsis amabilis* Blume).**—*Philipp. J. Sci.* **75** no. 2 pp. 185–195, 2 pls., 7 refs. Manila, 1941.

Specimens of the orchid, *Phalaenopsis amabilis*, received in Manila from Palawan in February 1940 were found to be severely infested by *Mertila malayensis*, Dist., all stages of which were found among the leaves, and investigations of the life-history of this Capsid, which was not previously known to occur in the Philippines, were carried out in February–May. A list is given of the countries from which it has been recorded, and all stages are briefly described. Injury to the orchids is due to the feeding punctures of the nymphs and adults in the leaves, peduncles and roots, and to oviposition punctures in the leaves. The eggs were inserted singly or in small groups in the tissues of the leaves, usually on the lower surface, a female depositing about 100 in 3 weeks. The egg and nymphal stages lasted 15–16 and 18–21 days, respectively, and the adults lived for up to 38 days. The nymphs are active and gregarious.

Suggested control measures comprise collecting and destroying all stages; the use of contact insecticides as sprays or dips; growing the orchids in screened houses; and segregating and examining new plants and treating them if necessary.

PAPERS NOTICED BY TITLE ONLY.

VAN EMDEN (F. I.). **Keys to the Muscidae of the Ethiopian Region: Scatophaginae, Anthomyiinae, Lispinae, Fanniinae.**—*Bull. ent. Res.* **32** pt. 3 pp. 251–275. London, 1941.

BRYANT (G. E.). **New Species of African Chrysomelidae (Col.)** [including *Longitarsus gossypii* on cotton in Sudan].—*Proc. R. ent. Soc. Lond.* (B) **10** pt. 11 pp. 209–214, 3 figs. London, 1941.

GOUX (L.). **Notes sur les *Trionymus* de la France et sur quelques espèces nouvelles pour la faune française (Hem. Coccidae)** [including *Lepidosaphes destefanii*, Leon., on olive in France and Corsica].—*Bull. Soc. Hist. nat. Afr. N.* **32** no. 1–4 pp. 31–44, 15 figs., 8 refs. Algiers, 1941.

[GRIGOR'ÉVA (T. G.). Григорьева (Т. Г.). **The Dynamics of Wireworms [*Agriotes* spp. in Vologda Province] as affected by a Crop Rotation including Grass.** [In Russian.].—*Bull. Plant Prot.* 1940 no. 4 pp. 57–64, 5 graphs, 12 refs. Leningrad, 1940. [For Summary see *R.A.E.*, A **29** 573.]

WOLCOTT (G. N.). **A Supplement to "Insectae Borinquenses."**—*J. Agric. Univ. P. Rico* **25** no. 2 pp. 33–158, 33 refs. Río Piedras, P.R., 1941. [Cf. *R.A.E.*, A **24** 768.]

FENNAH (R. G.). **Citrus Pests Investigation. Report on a Visit to Jamaica in November, 1940** [to determine the extent of damage to *Citrus* by *Prepodes*].—*Bull. Dep. Sci. Agric. Jamaica* (N.S.) no. 30, 8 pp., 1 fig. Kingston, Jamaica, 1941. [See *R.A.E.*, A **30** 167.]

NOTICES.

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